TECHNOLOGY DEPT.

POWER

AUGUST, 1944

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

Standardized propulsion units, quantity produced like this Westinghouse low-pressure wheel, power our fast ships

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Electronic frequency converter of 20,000 kw capacity, largest unit of its kind, ties a 25-cycle 44-kv to a 60-cycle 69-kv industrial power system. See page 101

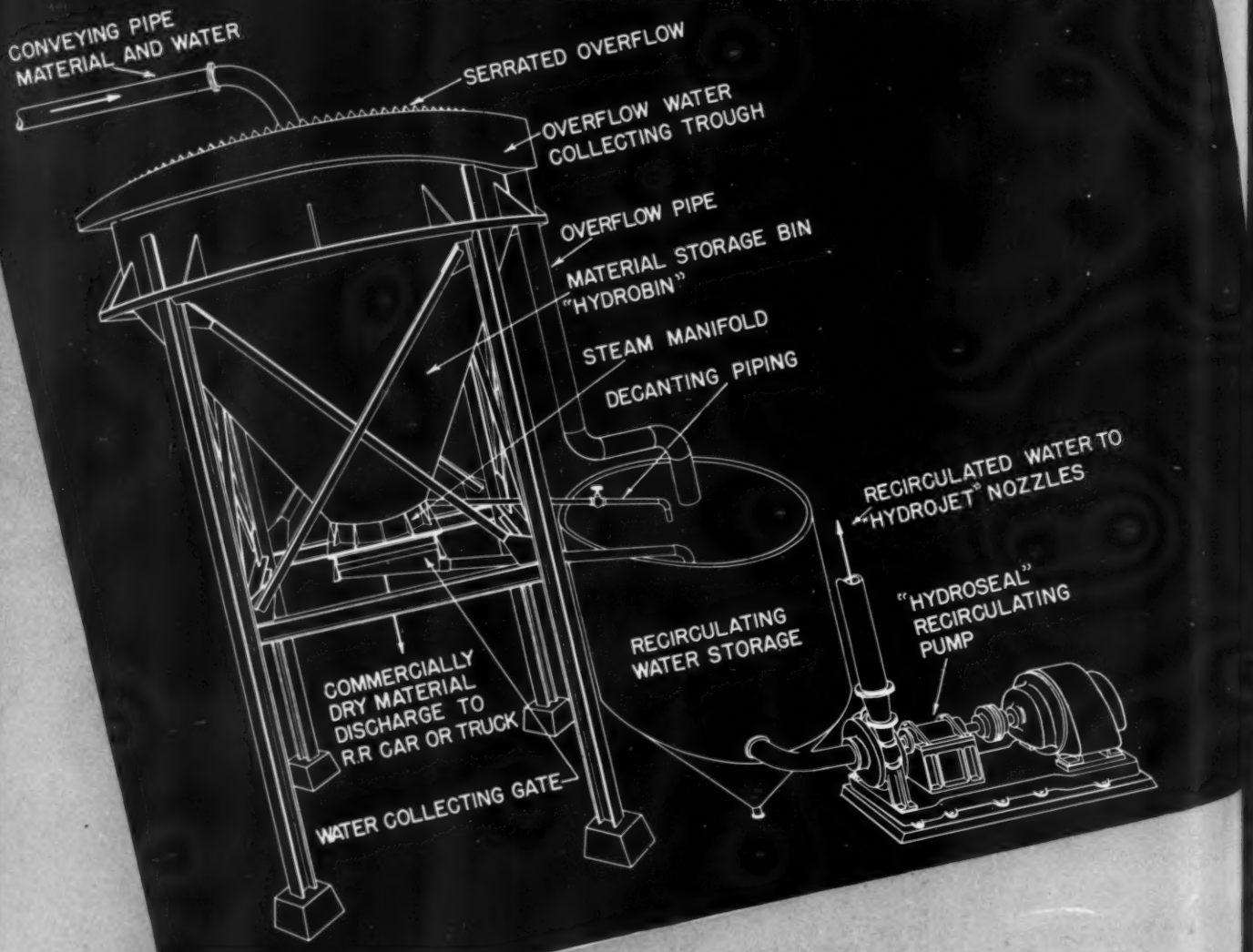
Diesel costs at Ponca City, Oklahoma, detailed for 15 years, show how use of low-grade fuel, smart operation and maintenance result in 4-mill power. Turn to page 72

"How to" articles: Pointers on packing pumps, p 67; guide for off-peak ice production, p 91; description of unique turbine-shaft repair, p 103; Navy's method of turbine-blade cleaning, p 105

Ashes Pumped WET—Delivered DRY

Ash and dust laden water enters the Hydro-Bin at the top; the water being removed by the overflow trough at the top, decanting elements at the sides and a water collecting gate at the bottom of the bin. Commercially dry refuse remains in the bin, for unloading into cars or trucks. Water removed from the bin can pass into a sewer or it may go to a storage tank, as illustrated, for recirculation through the Hydrojet System of Ash Removal or the Hydrovac System of Dust Removal. Hydroseal Pumps are used for pumping refuse into the bin and for recirculation of water. . . . The Dewatering Hydro-Bin is equipped with a steam manifold around the discharge gate, to insure operation in sub-freezing temperatures. Our nearest representative will gladly give you full information about this and other methods of refuse disposal available where Hydrojet and Hydrovac Systems are used.

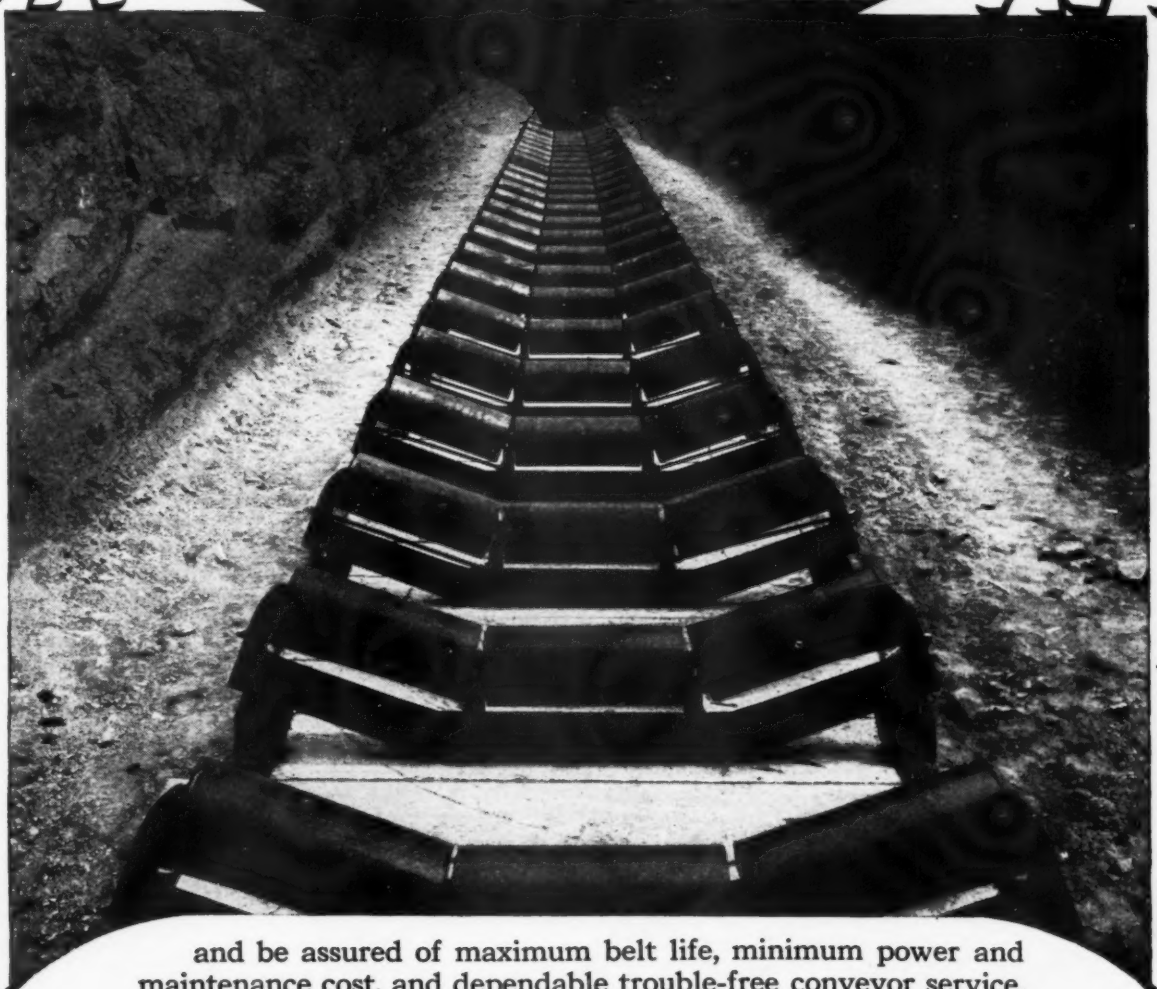
Dewatering HYDRO-BIN



ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. Offices & Representatives in Principal Cities

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), August, 1944, Vol. 88, No. 8. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

LAY THAT "BELT" DOWN ON
LINK-BELT
ANTI-FRICTION
BELT CONVEYOR IDLERS



and be assured of maximum belt life, minimum power and maintenance cost, and dependable trouble-free conveyor service. Link-Belt engineers pioneered in the development of anti-friction belt conveyor idlers and have consistently improved the original, fundamental design—the grease seal, bearing adjustment, shaft mounting and the supporting stands and brackets. All with the result that today's Link-Belt designs offer the very best in belt conveyor equipment.

9451

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8.
Offices, factory branch stores, and distributors in principal cities.

LINK-BELT

BELT CONVEYOR EQUIPMENT

IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

BACKING THE

BUY MORE WAR BONDS!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **BABCOCK**

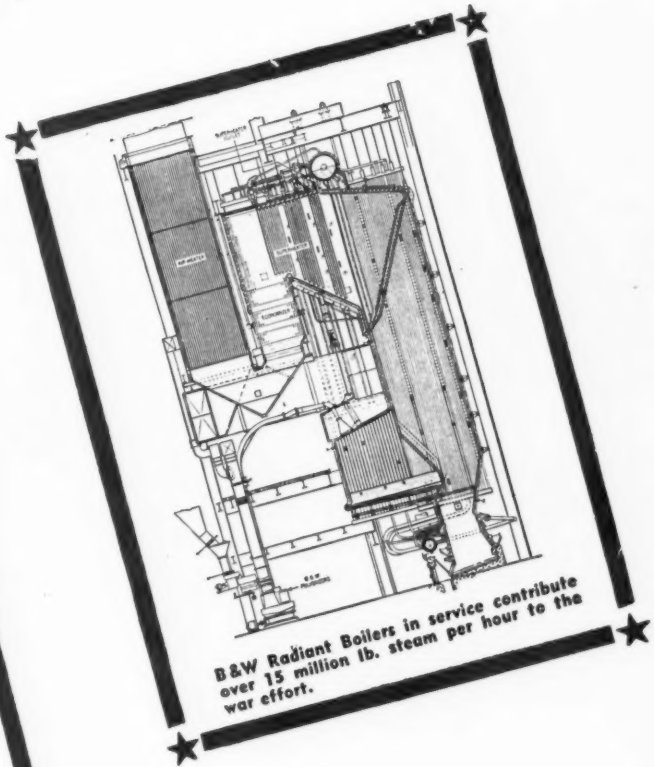
ATTACK...with POWER

What's back of the smashing offensive that is carrying the war to the Axis? The dynamic energy of management and labor . . . the amazing ingenuity of engineers . . . and, not least, the gigantic load shouldered by our public utilities and industrial power plants.

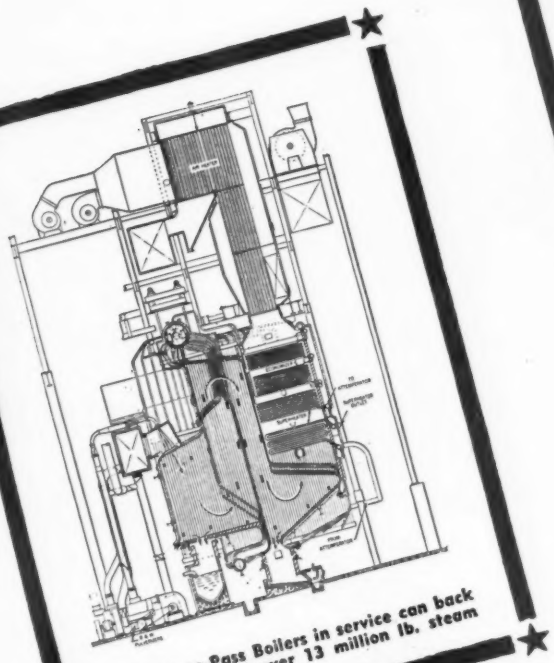
It would be impossible to over-emphasize the importance of power to the almost incredible production of ships, planes, tanks, guns, ammunition, and other war material. In producing steam to supply electrical energy, American power plants are keeping war-plant machines humming at stepped-up speeds never before attained. As J. A. Krug of WPB aptly sums it up, "Power has never been too little or too late."

Working with power plant executives and personnel has been a privilege for Babcock & Wilcox . . . and an opportunity to apply our experience in steam generation to the war-vital needs of expanding and maintaining boiler capacity.

We at B&W know that when the history of this war is written, the electric light and power industries will receive high recognition for a job well done . . . even wider recognition than the special citation already conferred upon them "for distinguished wartime achievement."



B&W Radiant Boilers in service contribute over 15 million lb. steam per hour to the war effort.



B&W Open-Pass Boilers in service can back the attack with over 13 million lb. steam per hour.

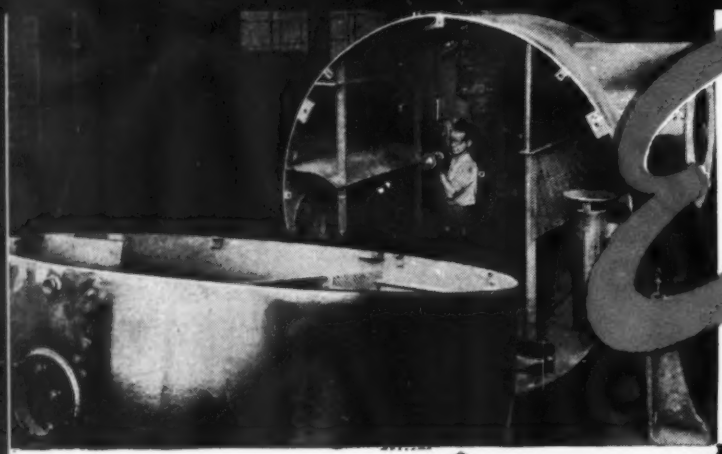
The Babcock & Wilcox Company

85 Liberty Street, New York 6, N. Y.

& WILCOX ★★★★★★★★★★★★

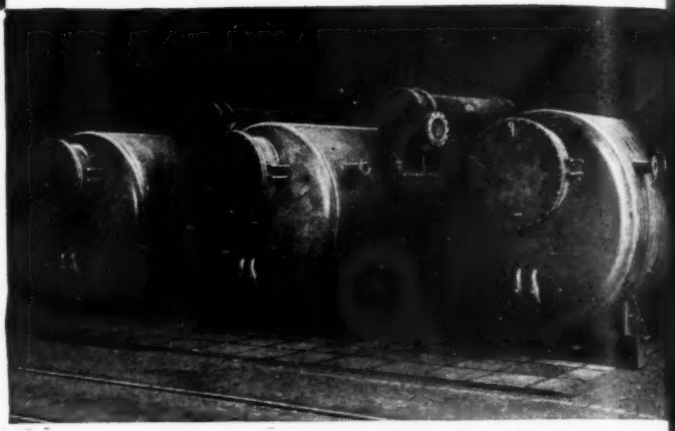
G-274TJ

Elliott

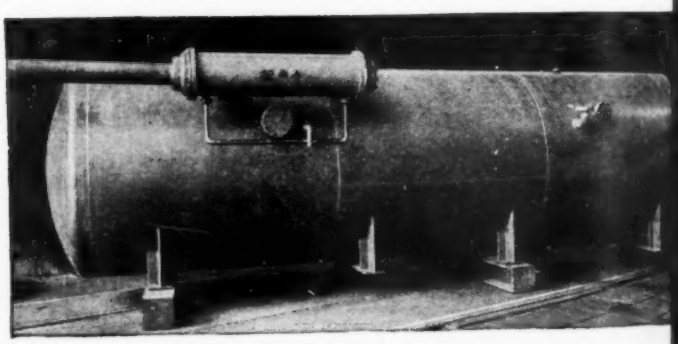


This Elliott deaerating heater was built in sections instead of with the shell in one piece so that it would go through the only available opening (a window frame) in the power plant in which it was to be installed.

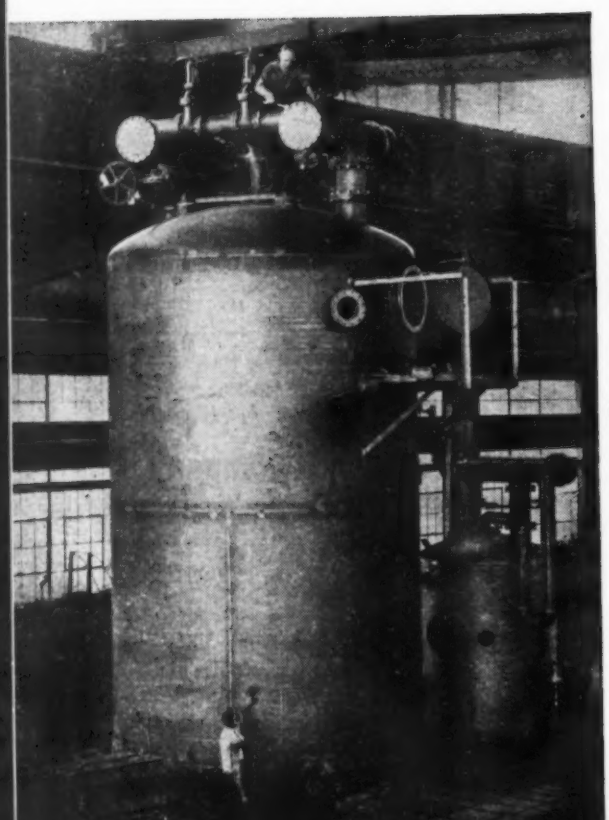
Typical medium-size vertical deaerating heater mounted on a horizontal storage tank. Vent condenser on side to save headroom.



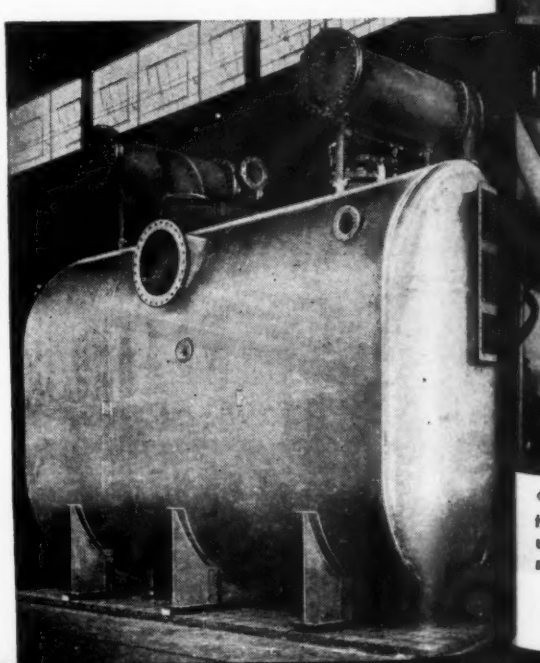
Standard horizontal deaerating heaters with special arrangement of vent condensers to cut down headroom.



A long horizontal unit especially designed to fit into appropriate space aboard a wartime floating power plant.



This 1,500,000-lb.-per-hr. deaerating heater was shaped to fit into limited width in a big utility station.



Two vertical deaerating heaters. Unit at left has twice the capacity of the one on the right, and eight times the storage capacity. It is about as big as can be placed in a railroad car — 12 ft. by 27 ft. high.

Deaerating Heaters-

custom-built for the job!

Elliott engineers excel in designing deaerating units to fit constricted space or installation conditions, and still perform with Elliott high standard efficiency. The desired amount of storage may mean a large single-shell unit, or a deaerating heater with a separate storage tank. Space limitations and available access to buildings must be given first consideration. Railroad clearances limit the size and shape of large units. And with each variation in shape, the critical design areas, volumes, tray and water distribution, piping arrangements, and controls must be proportioned for dependable operation and maximum feedwater heating and deaerating performance.

To assure this kind of performance, practically every deaerating heater must be considered as a special job. How well Elliott engineers meet this requirement is shown by the photos on these pages.

If you have a heater problem, particularly one of unusual character, talk it over with these Elliott specialists.

ELLIOTT COMPANY

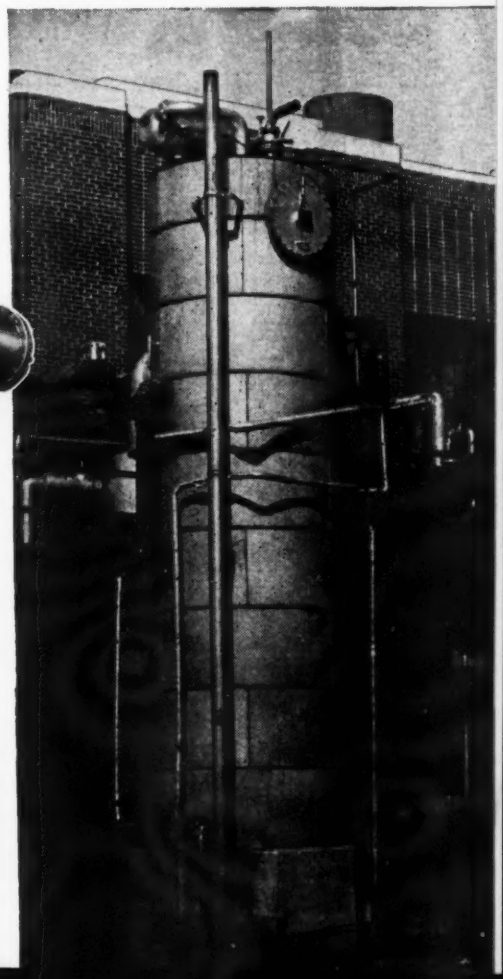
Deaerator & Heater Division, **JEANNETTE, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

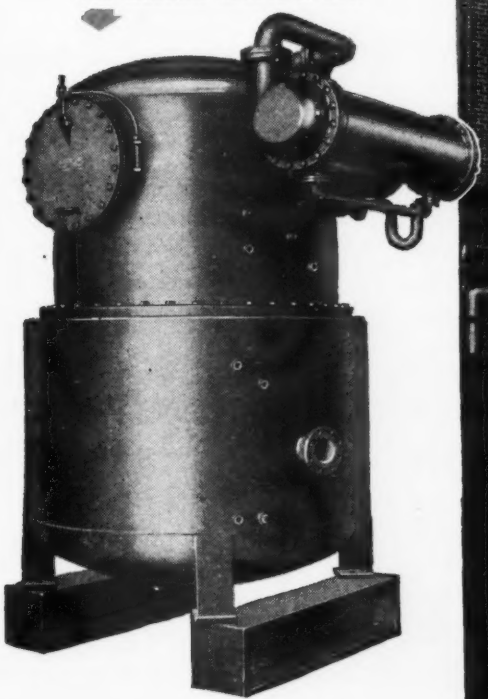
A star has been added to the Army-Navy "E" flags flown by both the Jeannette and the Ridgway plants of Elliott Company.

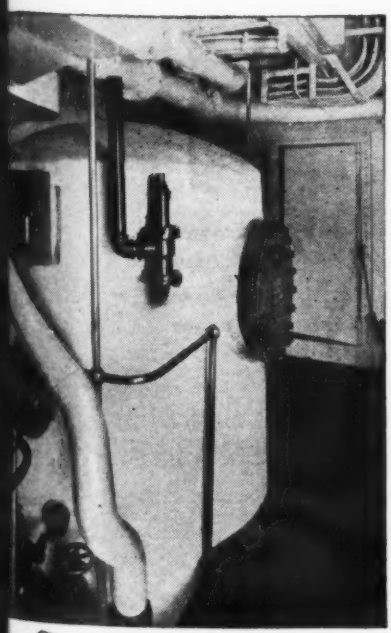
N-978

For outdoor installation, this Elliott deaerating heater was made to accommodate large water storage underneath the deaerating heater proper.



Low headroom deaerating heater, for installation in limited space in existing building, constructed so that lower part of unit could be put in place and the upper part slid over it. Vent condenser mounted on side.





Deaerating heaters for installation on board ship are built with the utmost compactness, usually with internal vent condensers, as illustrated.

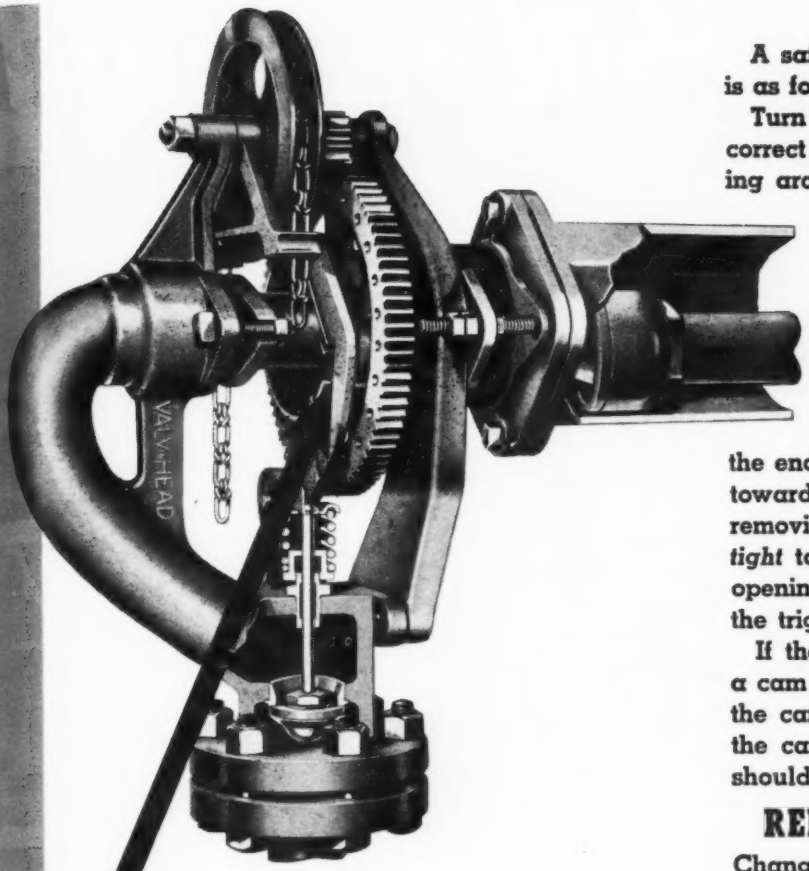
FOR BETTER BOILER CLEANING

Check SOOT BLOWER CAM SETTINGS PERIODICALLY

Position of cam and trigger of Diamond G9B Soot Blower just prior to beginning of blowing. Clockwise rotation of the cam will depress the trigger and open the valve.

Trigger is now completely depressed and valve is open. Length of cam determines blowing arc as valve remains open until trigger slips off other end of cam.

THROW YOUR *Scrap* INTO THE FIGHT



A MOST IMPORTANT PART of the Diamond G9B Soot Blower is the cam which opens and closes the valve—and which regulates the pressure where reduced pressure blowing is employed.

In any case, the cam determines the blowing arc. If it is not properly set, the blowing arc will be wrong. If the arc is too long, steam is wasted, and tubes, headers, baffles, etc., may be injured. If the arc is too short, effective cleaning is impossible.

Cams on all G9B heads should be examined periodically for tightness and correct position. Drawings furnished for installation of Diamond Soot Blowers show the correct blowing range for each unit. It is important that nozzles should not blow directly into boiler headers, drums, baffles, etc., at close range with full pressure.

A safe method for checking or setting cams is as follows:

Turn the element so that the nozzles are in correct position for the beginning of the blowing arc. With the head in this position, place the opening end of the cam (the beveled end with the slot in it) in contact with the end of the trigger. Then attach the cam to the gear wheel by means of two cam bolts made up handtight, and turn the head until the nozzles are in correct position for the end of the blowing arc. Mark the cam directly at the end of the trigger, and cut it off 2¼" back toward the beveled end from this point after removing it from the gear wheel. Then bolt *tight* to the gear wheel, making sure that the opening end of the cam comes in contact with the trigger first.

If the blowing arc is so short as to require a cam 3" long or less, cut off only the face of the cam and leave at least five bolt holes in the cam flange. Not less than two cam bolts should be used.

REDUCED PRESSURE BLOWING

Changes in baffles, etc., may require reduced pressure blowing through part of the arc. Special cams should be used to provide any needed sequence of reduced and full pressure blowing.

360° ARC BLOWING

Some conditions require a unit to blow through the entire revolution. In such cases, 360° cams and triggers should be used.

GET ***MORE*** OUT OF THE SOOT BLOWERS YOU HAVE

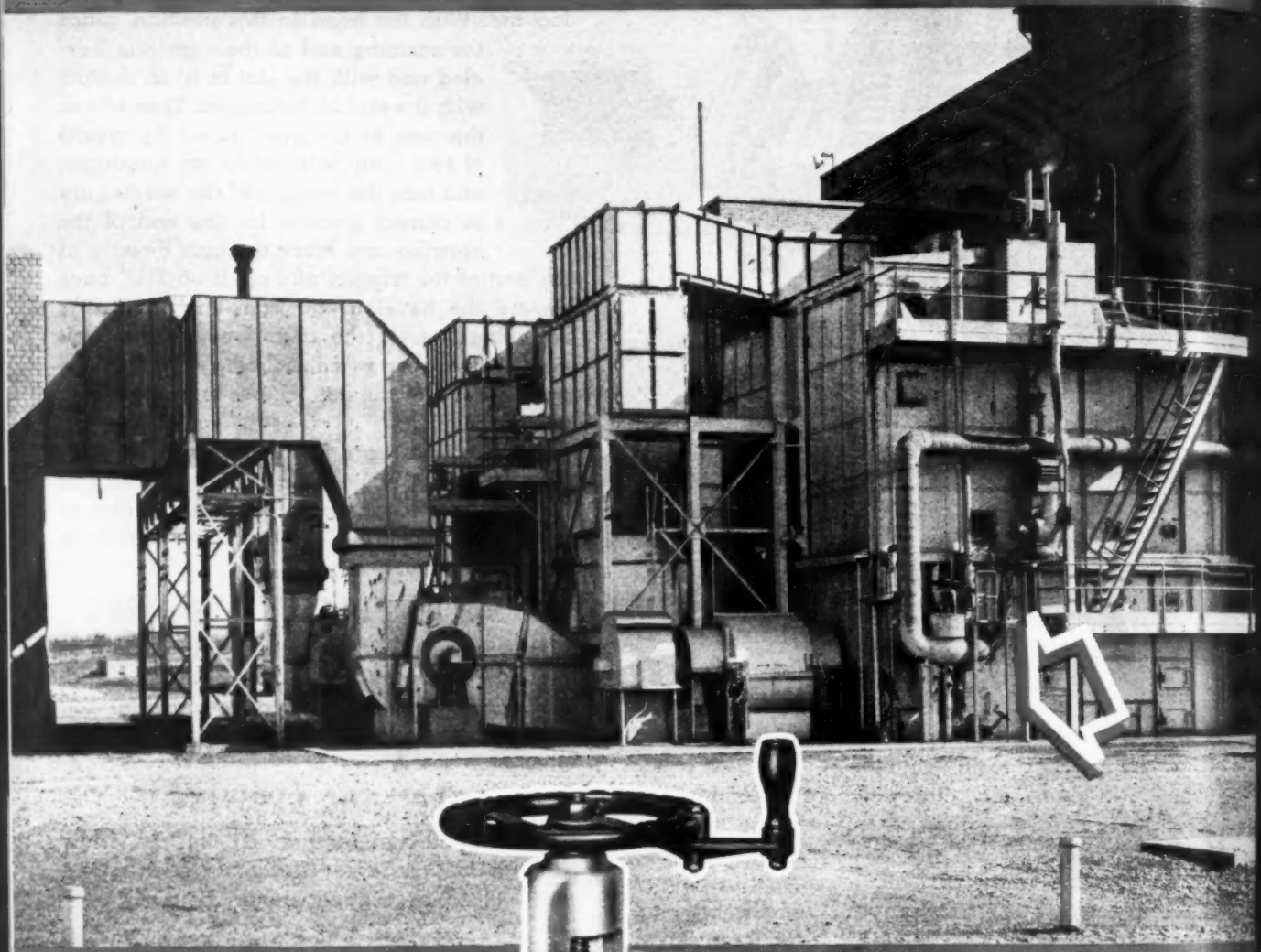
War demands often make it difficult for us to supply new blowers or repair parts as promptly as we'd like. Careful maintenance will prolong the useful life of the blowers you have. This booklet tells you how to maintain, adjust and repair Diamond G9B Soot Blowers. *Write for a copy.*

DIAMOND POWER SPECIALTY CORP.

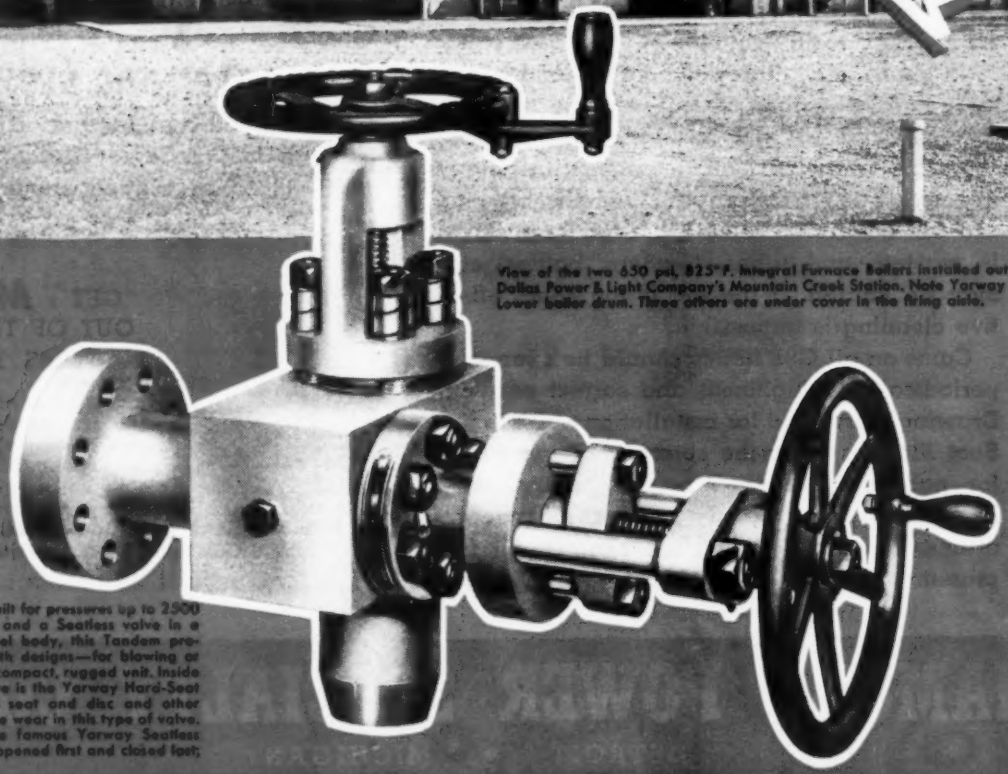
DETROIT • MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

"Outdoor Power Plant



View of the two 650 psi, 825° F. Integral Furnace Boilers installed out-of-doors at the Dallas Power & Light Company's Mountain Creek Station. Note Yarway Unit Tandem on lower boiler drum. Three others are under cover in the firing aisle.



Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—for blowing or draining and seating—in a compact, rugged unit. Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve with special Stellited seat and disc and other features which greatly reduce wear in this type of valve. Outside sealing valve is the famous Yarway Seatless design. This valve is always opened first and closed last; maintaining a tight seal.

YARWAY

t selects YARWAY Unit Tandems

A power plant, literally, with no "overhead"! That is Dallas Power & Light Company's Mountain Creek Station, where two 650 psi, 825° F. Integral Furnace Boilers handle a capacity load of 400,000 lb of steam per hour, out in the open with only the firing aisle under cover.

The selection of Yarway Unit Tandems for this unique installation was undoubtedly influenced by the satisfactory performance of Yarway Valves at the Dallas Station where they have been in use for 18 years.

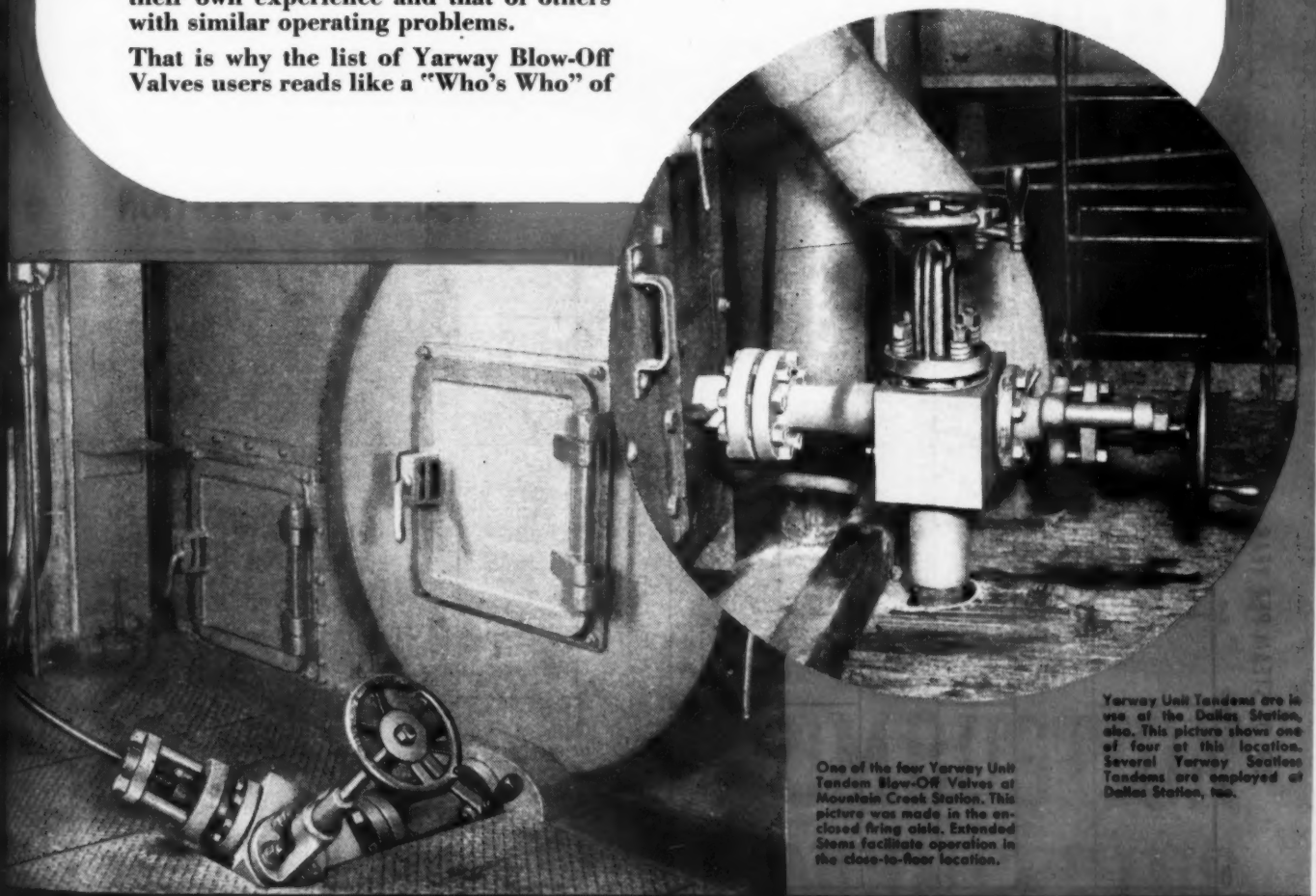
Careful purchasers buy on experience—their own experience and that of others with similar operating problems.

That is why the list of Yarway Blow-Off Valves users reads like a "Who's Who" of the leading Utilities, Industrials and Institutions of America.

What are your blow-down or draining and sealing problems? Play safe and select Yarway Valves—the best insurance against trouble and expense and resultant costly shut-downs.

Write for Catalog, Section B-431 for pressures from 400 lb to 2500 lb. Section B-424 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.



One of the four Yarway Unit Tandem Blow-Off Valves at Mountain Creek Station. This picture was made in the enclosed firing aisle. Extended Stems facilitate operation in the close-to-floor location.

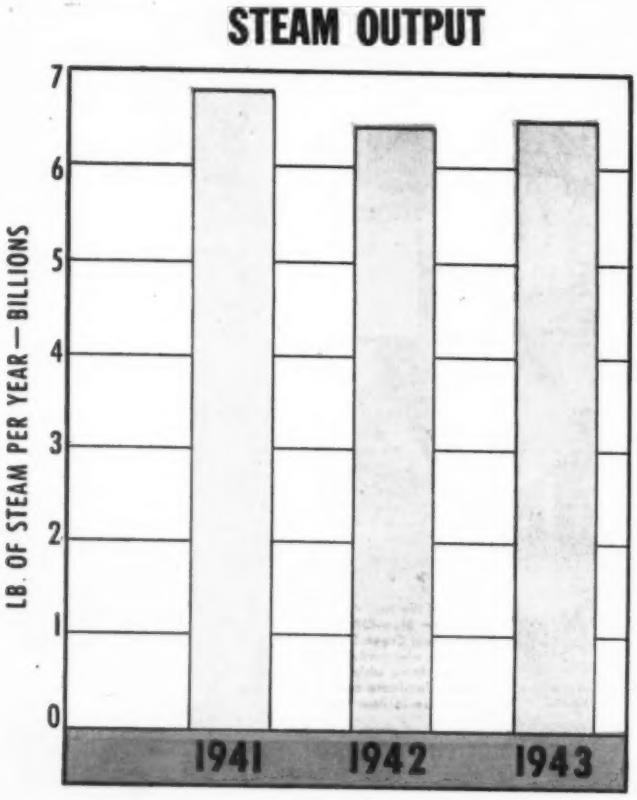
Yarway Unit Tandems are in use at the Dallas Station, also. This picture shows one of four at this location. Several Yarway Seatless Tandems are employed at Dallas Station, too.

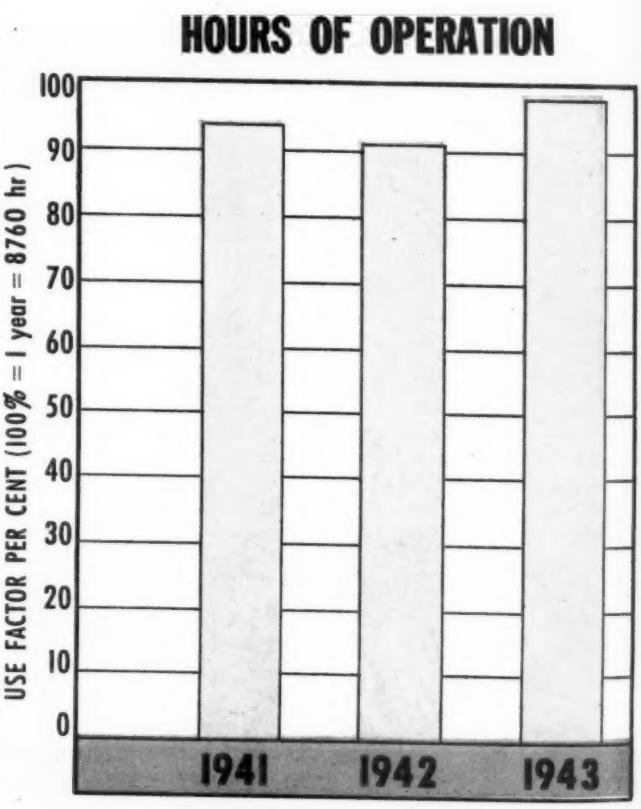
BLOW-OFF VALVES

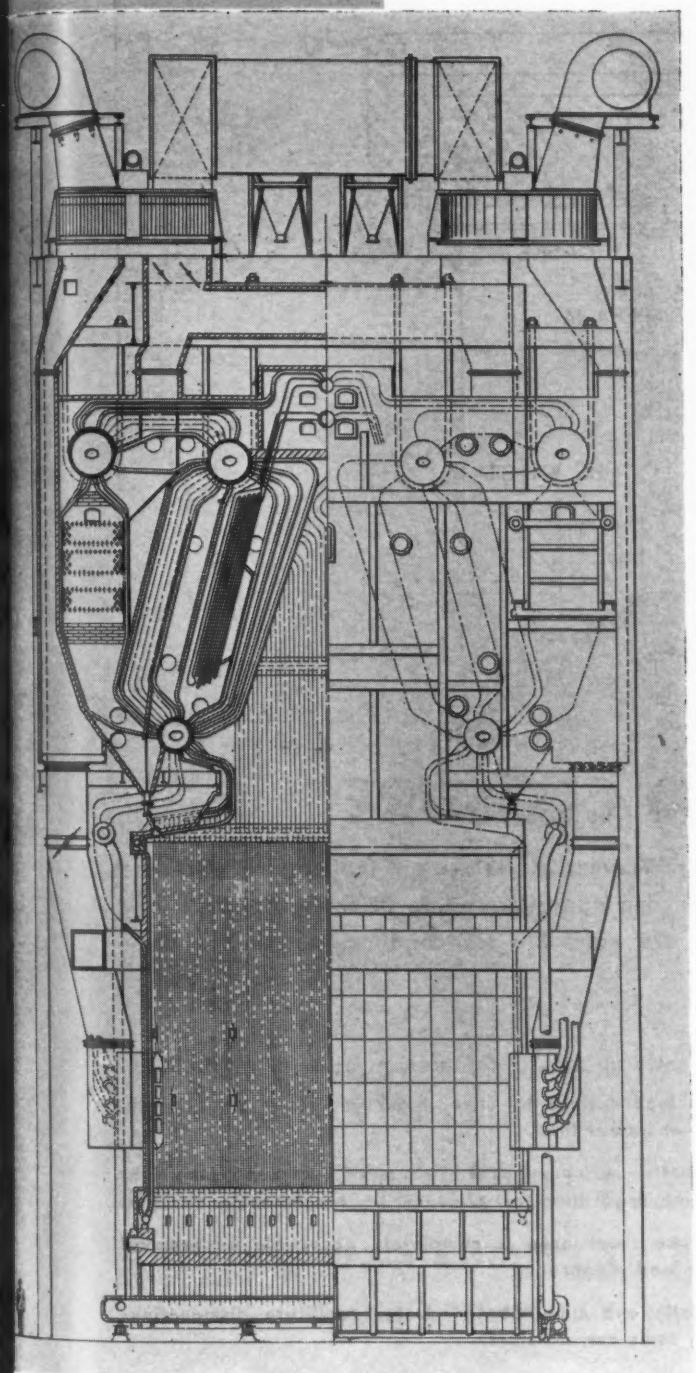
In 3 YEARS of war-time service this C-E Steam Generating Unit was "on the line" 94.3% of all the time

producing nearly 20,000,000,000 lb of steam

(an average of 800,000 lb per hour)







C-E Steam Generating Unit, installed in 1937 by a large Eastern utility. Designed to produce 1,000,000 lb of steam per hr at 1340 psi and 925 F. Serves 1 — 40,000-kw high-pressure turbo-generator and 5 — low-pressure units with a combined output of 50,400-kw — an aggregate of 90,400-kw.

BETTER than words can describe, the two charts on the left page covering

1. steam output
2. use factor

quickly tell the complete story of the exceptional performance of an exceptional C-E steam generating unit, during the past three years.

Such reliable operation and high steam output have contributed importantly to our national war effort. For this big C-E unit is installed in a power plant of a utility system that serves many war factories and also one of the country's largest coal mining areas where it is producing the power needed to mine this critical material upon which so much other war production must rely.

This is another outstanding example of how effectively the public utilities of the United States are meeting the challenge of our wartime emergency. It is also another example of the exceptional performance qualities built into all Combustion Engineering equipment.

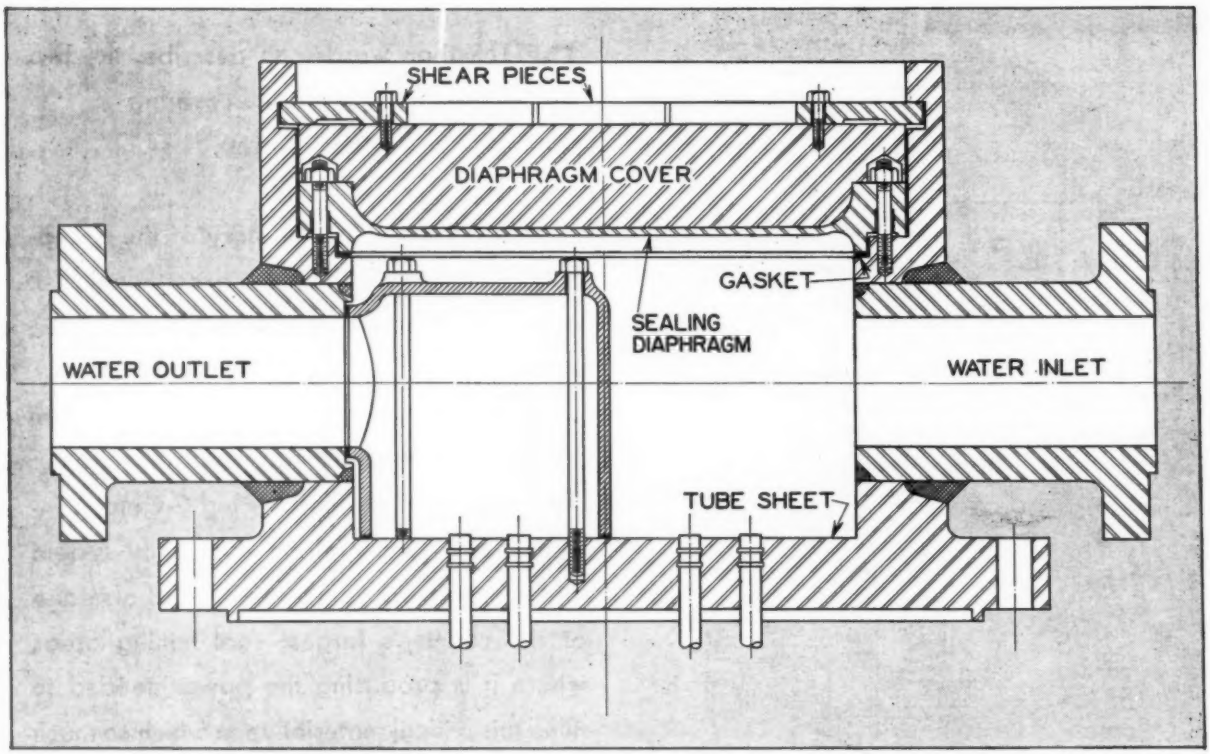
A-801

C-E

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N.Y.

Blazing THE



LOCKHEAD CLOSURE

The "Lockhead" closure, developed by Foster Wheeler in 1931, is still the simplest and most efficient design for high pressure heads. Units are operating up to 3200 lb. pressure and range in size to 10 ft. in diameter. Designs are available for conditons exceeding these limits.

Foster Wheeler is a Four Star Winner under the U. S. Navy Board of Awards for production.

Unique advantages of this design are:

1. **Pressure load carried by cover block and shear pieces, independent of gasket load.**
2. **Gasket bolts are independent of pressure load and insure tight main joint regardless of pressure or temperature changes.**
3. **Entire tube sheet area is completely accessible on removal of cover and diaphragm.**
4. **Small bolts and simplicity of design facilitate dismounting-ordinary tools are sufficient.**

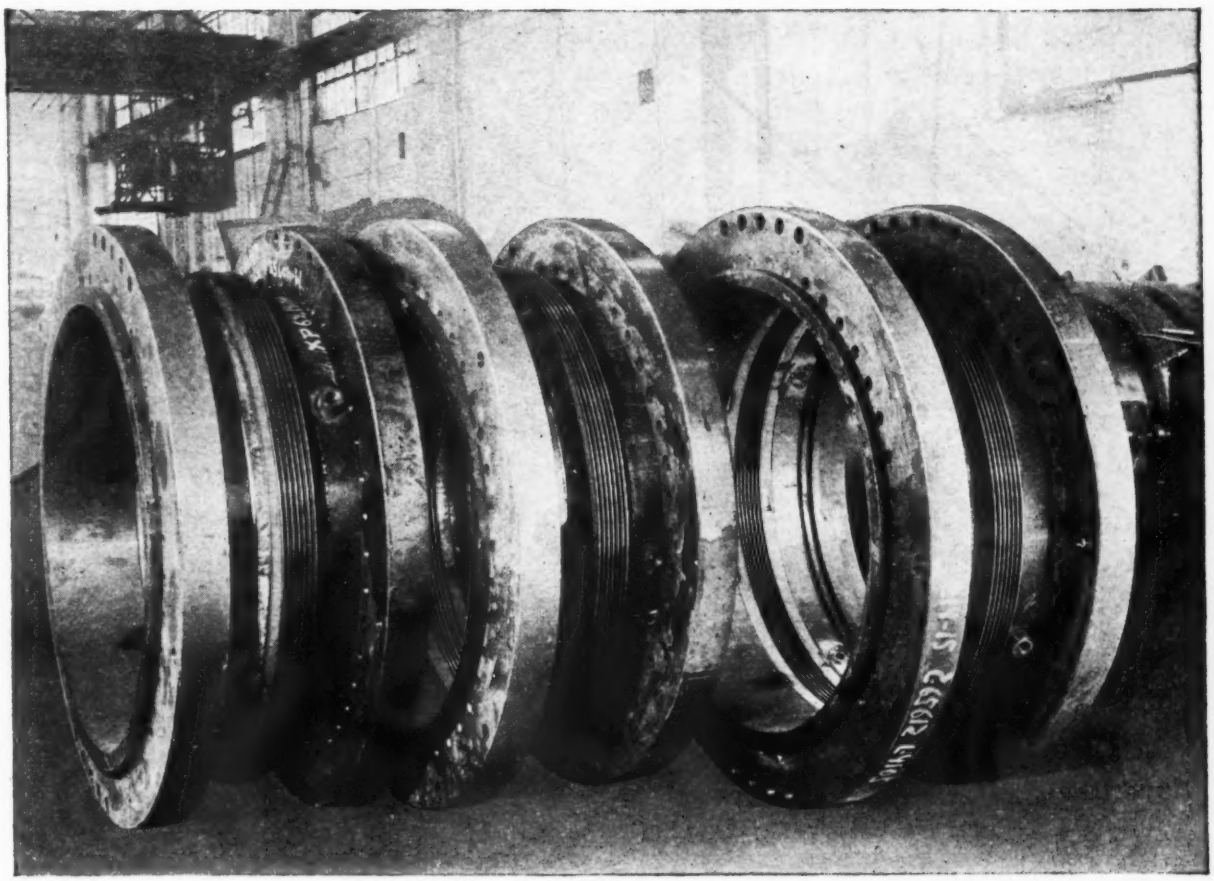
FW FOSTER

ENGINEERING TRAIL

TYPE "S" EXPANSION JOINT

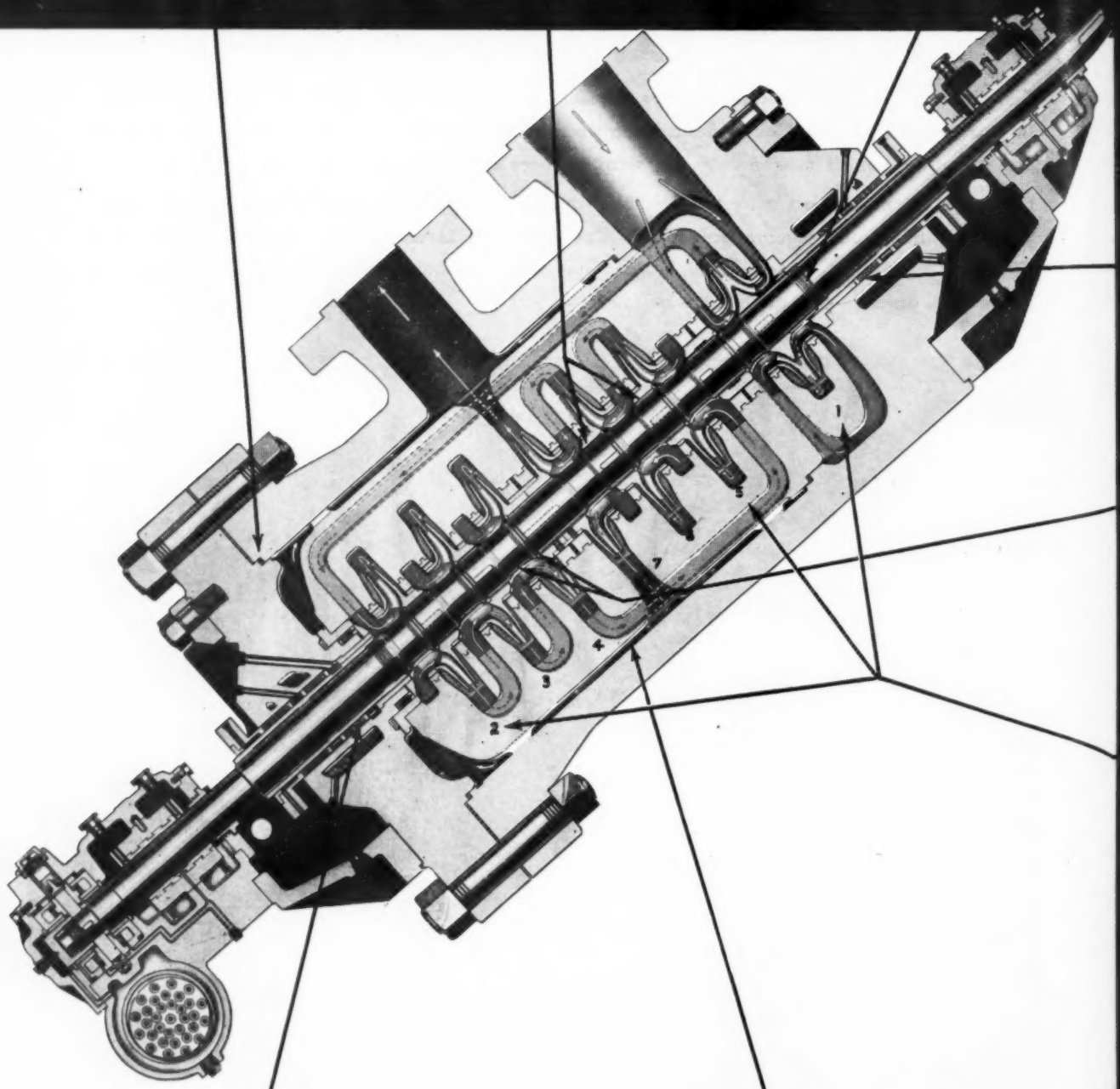
The first "S" type all-welded bellows expansion joint went into operation during 1934. Since then over 4500 of these joints have been designed and built by Foster Wheeler for all types and combination of movements, for temperatures to 1800°F. and pressures to 600 psi.

Flexibility of movement afforded by joint design and stainless steel bellows permits operation with minimum mechanical force. The assembly is electrically welded by the Foster Wheeler "Sta-Norm" process which does not alter the stainless or physical characteristics of the steel discs at any part of the bellows.



FOSTER WHEELER CORPORATION
165 BROADWAY, New York 6, N. Y.

WHEELER



SECTIONAL VIEW • TYPE HDB • SEVEN STAGE, DOUBLE CASE BOILER FEED PUMP

P ted every design feature of Byron Jackson Double Case

BOILER FEED PUMPS

Out of the wealth of seventy-two years of pump experience has come this tested and widely proven design, hydraulically balanced, simply constructed, with all parts easily accessible.

Mounted in a plain cylindrical outer case, the inner case, in two halves, by a double volute design, eliminates radial thrust and by its staging arrangement excludes axial thrust. Thus a rotating element with a light shaft, completely mounted before assembly, is made possible.

No hiding of one stage, while mounting the next, no balance drum or disc, no distance piece between impellers. These, together with other simplifications, make it ideally suited for modern power plants of the highest pressure and temperature.

Our engineers will welcome consultation on your high pressure pumping problems.

SEND FOR BULLETIN NO. 42-4500

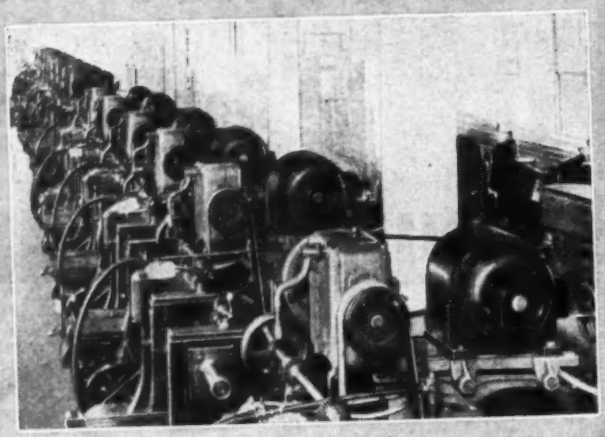
Devoted exclusively to the unique design features of Byron Jackson Double Case Boiler Feed Pumps, every plant engineer will find this bulletin of interest.

NOTE:

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

BEARINGS BEAR UP

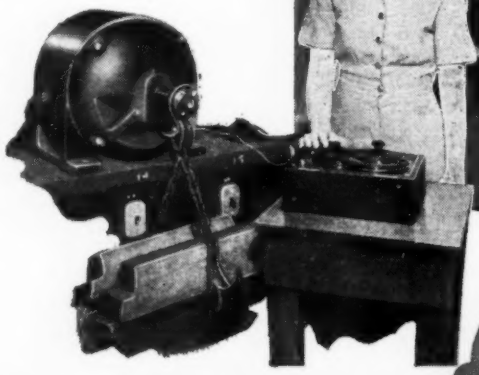


Powered by Tri-Clad sleeve-bearing motors, this battery of milling machines has been in round-the-clock operation on war work since before Pearl Harbor. The short-center, hinge-base drives put a hard, steady pull on the motor bearings. In addition, the machines are in the hands of several different operators each day, many newly trained. Despite the severe service, motor-bearing performance has been above prewar levels. Maintenance manpower has been conserved, and production held on schedule.

Tri-Clad motors driving milling machines in the River Plant Division of the Savage Arms Corp., Chicopee Falls, Massachusetts.

How torture tests on TRI CLAD bearings have helped us lengthen motor life

Before the Tri-Clad motor-bearing designs were adopted, many models of this new motor were tested to destruction under heavy shaft loadings applied from all directions, with various kinds of lubricants, and under many different speed and temperature conditions. As new Tri-Clad types are introduced, these tests continue—some for years—in "torture" areas such as shown at right. Each test broadens our knowledge, offers new clues to longer motor life. Throughout industry, results have substantiated the improved bearing performance forecast by these tests. *General Electric Company, Schenectady 5, New York.*



GENERAL ELECTRIC

Buy all the **BONDS** *you can* — **AND KEEP ALL YOU BUY**

Hardness

...WHAT IT MEANS IN A METAL
WHAT IT MEANS TO A METAL USER

Next to strength, the property usually most sought in a metal is *hardness.*

A dictionary calls a material hard when it is "not easily penetrated, cut, or separated into parts, not easily yielding to pressure."

Others call it "the ability to resist plastic deformation," and "resistance to indentation or penetration."

In short, an exact definition of hardness seems to have stumped even Webster.

What hardness *is,* however, is not so important as what it *does.*

Generally, the harder a metal, the greater its resistance to frictional wear, the better it fights the blasting action of grit and other abrasive substances, and the longer it holds off the erosive effect of steam or water.

Though hardness must share credit with toughness and ductility for resisting most forms of wear, hardness usually gets the nod as the most important of the three.

Since no one method of hardness testing is applicable to all shapes of materials, several types of testing machines have been developed. Of these, the Brinell, Rockwell and Vickers machines are basically similar, as all measure penetration of the metal under test... by ball, cone or pyramidal indenter. The Scleroscope measures hardness by the "bounce" of a diamond-tipped hammer.

As a group, the INCO Nickel Alloys are in the upper hardness range, varying from medium to very hard, as shown in the chart at the bottom of this page.

Note the exceptional hardness of "K" Monel, "Z" Nickel, and "S" Monel.

"K" Monel can be heat-treated after finishing, for applications that require a corrosion-resisting material with extremely high strength and hardness. "S" Monel is an extremely hard and strong cast alloy for non-galling valve trim, pump liners, etc. It retains high hardness at red heat. "Z" Nickel, one of the hardest non-ferrous alloys obtainable, can be heat-treated after forming to develop 2½ to 4 times the strength of structural steel.

The practical advantages of hardness are illustrated by the record of the Monel rods in the pump shown above. The pump has been at work since 1918, handling gritty waters from ash quenching and corrosive waters from coal drainage. The Monel rods have given trouble-free service during the whole quarter-century.

A second pump was installed ten years after the first. Its rods were made of bronze. Three sets failed in less than 10 years. Monel rods were then installed. The second pump, like the first, has had no rod trouble since that time ...the *hardness* of Monel along with its greater corrosion resistance, rigidity and toughness has made the difference.

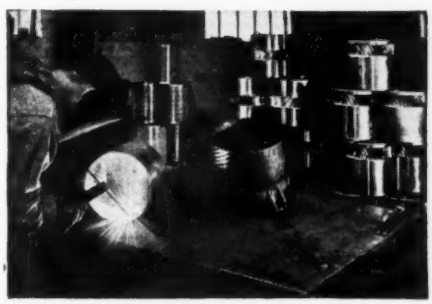
Another application that shows how Monel's hardness cuts down trouble is the use of Monel steam separators for cargo vessels.

SUMP PUMP *with long-wearing hard Monel rods at work in New York Public Library for over 25 years.*

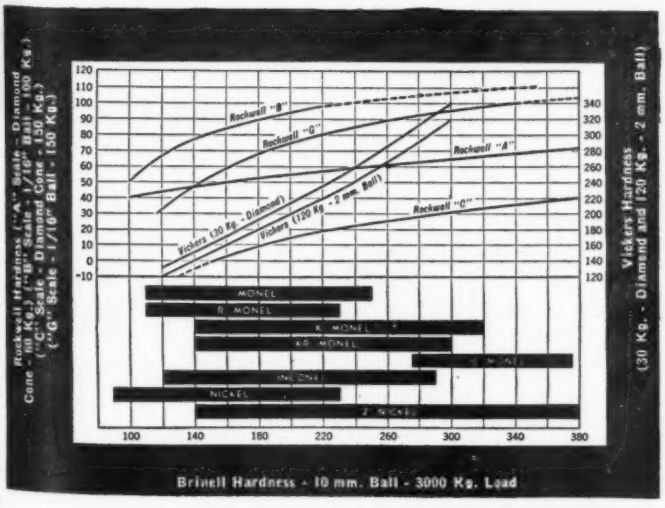
Steam coming direct from a boiler carries moisture and solid particles. This foreign matter would blow through the lines and erode the vital parts of equipment if the separator did not remove it.

Formerly, the Dri-Steam Products Co. used thick castings of a softer corrosion-resistant metal as inner cylinders for the separators. The cylinders often failed from erosion after only three months' service.

An improved type of separator was then fabricated from Monel sheet. Half the weight, and a third less expensive than the old type, the Monel separators have been in use for over two years. Not one has failed... Monel's added hardness has again produced longer, trouble-free life.



STEAM SEPARATORS *of hard Monel sheet, cut cost 30%, weight 50% ... and give over 8 times the service of former type. Made by Dri-Steam Products Co., New York, N. Y.*


Rockwell Hardness ("A" Scale - Diamond Cone - 60 Kg. - 1/16" Ball - 100 Kg.)
("C" Scale - Diamond Cone - 150 Kg.)
("G" Scale - 1/16" Ball - 150 Kg.)
Rockwell "B"
Rockwell "G"
Rockwell "A"
Rockwell "C"
Vickers (30 Kg. - Diamond)
Vickers (120 Kg. - 2 mm. Ball)
MONEL
R MONEL
K MONEL
KR MONEL
S MONEL
INCONEL
NICKEL
Z NICKEL
Vickers Hardness (30 Kg. - Diamond and 120 Kg. - 2 mm. Ball)
Brinell Hardness - 10 mm. Ball - 3000 Kg. Load

HARDNESS OF INCO NICKEL ALLOYS. *The hardness range of each alloy is shown by the horizontal bars; the approximate relation between Brinell, Rockwell and Vickers hardness numbers is shown by the conversion chart.*

For further light on hardness... and on other mechanical properties that determine a metal's suitability for specific applications... write for a copy of the 26-page bulletin, "The Technical Editor Speaks..." A copy is yours for the asking.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.

EXTRA

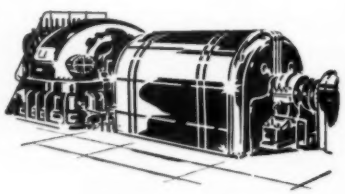
...added to a base stock that
high-grade, long-

NEW GARGOYLE

THIS great new turbine oil — Gargoyle D. T. E. Oil 797 — combines all three of the factors needed to make the ideal turbine oil — a base stock that is in itself an excellent turbine oil, maximum resistance to oxidation and maximum anti-rust qualities.

As a result, Gargoyle D.T.E. Oil 797 has already proved its superiority. In severe oxidation tests, it stood up a great deal longer than other leading turbine oils.

Now, Gargoyle D.T.E. Oil 797 is meeting today's greatly increased operating temperatures in turbines ranging from 1500 KW to 50,000 KW.



Your local Socony-Vacuum representative can give you full details about this new oil. Be sure to get the facts from him... and get Gargoyle D.T.E. Oil 797 in your turbine.

SOCONY-VACUUM OIL COMPANY, INC. • Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corporation of California

FROM THE WORLD'S LEADER IN LUBRICATION

RESISTANCE TO OXIDATION, RUST

...s in itself an excellent, ...asting Turbine Oil...

...D.T.E. OIL!

GARGOYLE

Lubricants

WHAT MAKES A GREAT TURBINE OIL?

✓ ***Excellent Base Stock:*** The fundamental requirement for an ideal turbine oil is a base stock that in itself is an excellent turbine oil with excellent resistance to oxidation.

✓ ***Extra Resistance to Oxidation:*** Oxidation protection—PLUS—is needed to meet the effect of greatly increased temperatures in modern turbine operation. Your turbine oil should have this PLUS protection.

✓ ***Maximum Anti-Rust Qualities:*** The possibility of the presence of water demands that the oil should furnish maximum protection against corrosion. Your turbine oil should give this protection.

THE NEW GARGOYLE D.T.E. OIL 797 HAS ALL OF THESE NECESSARY CHARACTERISTICS

Socony-Vacuum Oil Company, Inc.

The gearmotor combines prime mover and speed reducer in a single compact unit. It eliminates the long center-to-center distances of belt drives . . . the space-consuming arrangement of open gearing . . . and the extra floor area required by a separate speed reducer. You can fit a gearmotor up *tight* against the driven machine.

Here's typical example of how gearmotors save space: when a gearmotor replaced the old slow-speed drive on a paper mill calender—*40 square feet of floor space was saved.*

Gearmotors are making equally substantial savings in many other types of applications.

Flexibility in rearranging equipment is another gearmotor advantage. For, in requiring less space, it makes relocation of equipment easier and faster. Ask your Westinghouse representative about this and many other basic gearmotor advantages. All of these are discussed in detail in new book, "Gearmotor Applications". Ask for B-3218. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-07218

Second of a series sponsored by Westinghouse to promote the use of gearmotors.

The New Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Type B—Double-reduction gearmotor available in standard ratios from 31.2:1 to 58.3:1, inclusive.
Type C—A double-reduction unit for standard ratios from 7.6:1 to 25.7:1, inclusive.
Type A—This single-reduction gearmotor is available in standard gear ratios from 1.22:1 to 6.25:1, inclusive.

10 GOOD REASONS FOR USING WESTINGHOUSE GEARMOTORS

1. FEWER PARTS TO WEAR. The simple, efficient design uses a minimum of moving parts.

2. BPT "TOUGH-HARD" GEARS AND PINIONS. This exclusive Westinghouse heat-treating method "tough-hardens" teeth for maximum resistance to shock and impact—means longer wear.

3. USE ALL WESTINGHOUSE MOTOR TYPES—open . . . totally-enclosed . . . splashproof . . . explosion-proof —to help meet changes in operating conditions quickly and easily.

4. INTERCHANGEABILITY OF PARTS between unit types reduces your parts' replacement stock by 40%.

5. HIGH EFFICIENCY of gearing parts assures full motor horsepower at output shaft . . . only 2% power loss per gear set.

6. POSITIVE LUBRICATION of gears and bearings by automatic splash system reduces probable maintenance to twice-a-year change of oil.

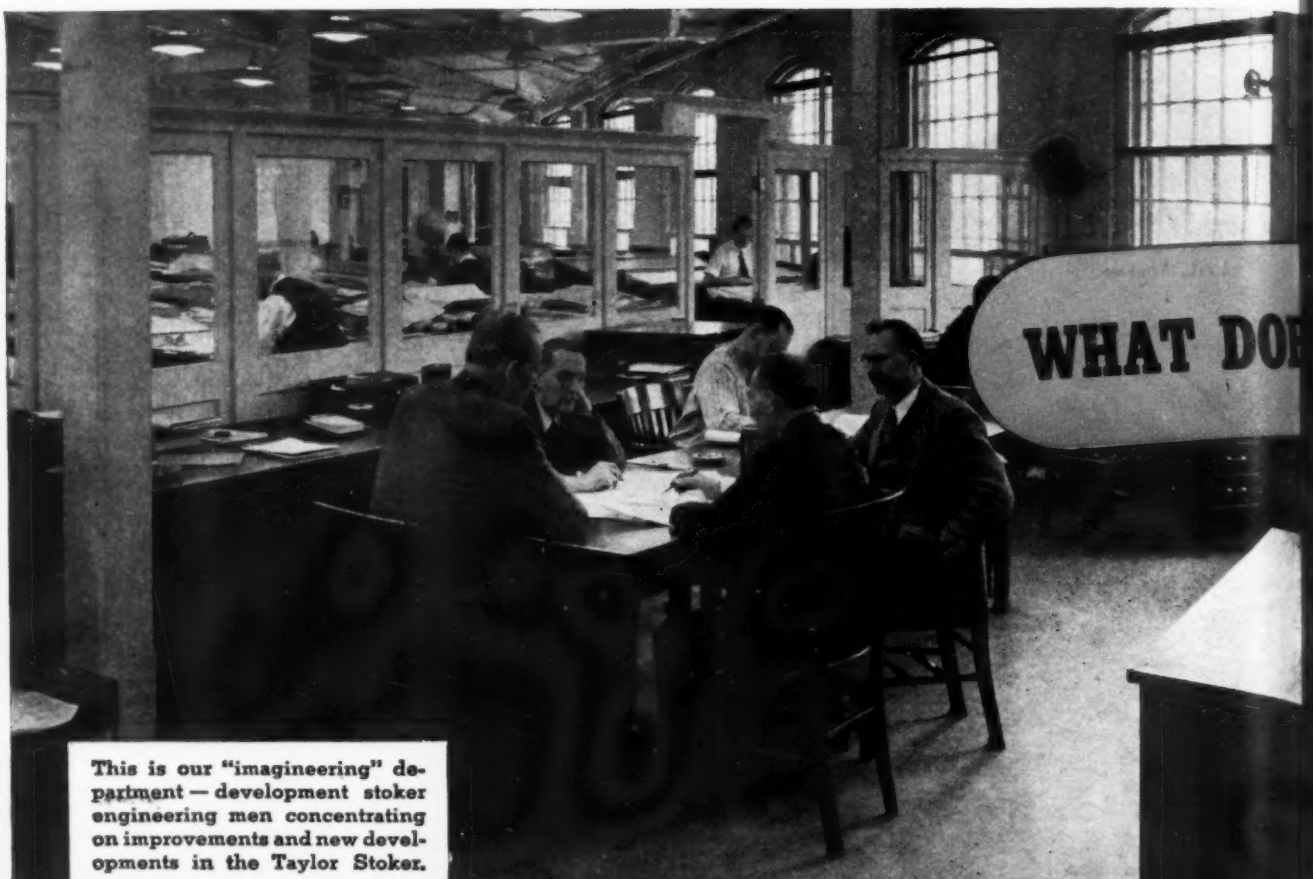
7. EASY ACCESSIBILITY. Gearing parts can be readily inspected or easily removed to effect gear ratio changes.

8. IMPROVED FOUNDATION STABILITY. Feet are under the gear case . . . placing support next to the gearmotor load. Each foot is reinforced by external ribs.

9. UNIT RESPONSIBILITY for design . . . manufacture . . . and service. Westinghouse builds both the motor and the gears.

10. MEET A.G.M.A. STANDARDS. The new Westinghouse Gearmotors are specifically designed and built to meet A.G.M.A. standards . . . easy to order and match to the job.

Gearmotors



This is our "imagineering" department — development stoker engineering men concentrating on improvements and new developments in the Taylor Stoker.

General engineering offices of th American Engineering Compan Many of these men have a record of 1 15, 20 or more years of stoker eng neering experience under their ha

ENGINEERING EXPERIENCE HAVE TO DO WITH

STOKER PERFORMANCE?

IT TAKES a real amount of engineering ability to sit down and design a stoker. But to design a reliable stoker from which you can derive the maximum possible operating efficiency at the lowest cost requires another ingredient—STOKER ENGINEERING EXPERIENCE.

Stoker engineering experience isn't something one can read up on in a book. It is the sum total of years of perfecting and rejecting principles, of designing, testing and redesigning, of developing ideas and observing them under actual operating conditions. It contributes "know-how", the factor of experience which is beyond the direct interpretation of drawings and which results from having designed and installed so many multiple retort stokers in this and other countries.

Stoker engineering experience investigates every single part of a stoker trying to make it work better, last longer, or make it easier or cheaper to replace.

These engineering advantages, the culmination of 40 years of *stoker* engineering experience are an integral part of Taylor Stoker manufacture—another plus to add to many Taylor mechanical features which assure you efficient, reliable, low cost generation of steam.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. RELIABILITY—the ability to operate with minimum outage and minimum standby equipment.

2. CAPACITY—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.

3. MAINTENANCE—the ability to operate continuously with minimum repair costs.

4. FLEXIBILITY—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.

5. EFFICIENCY—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.

6. OPERATION—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.

7. ADAPTABILITY—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.

8. FUEL FLEXIBILITY—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.

9. REFUSE DISPOSAL—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.

10. STACK DISCHARGE—the practical elimination of "smoke nuisance" without special equipment.

11. SPACE REQUIREMENTS—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.

12. OBSOLESCENCE—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

A-E-CO TAYLOR STOKERS • LO-HED HOISTS
HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

AE CO

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25 • PENNSYLVANIA

New Enough

TO BE DIFFERENT

Old Enough

TO BE TRIED AND PROVED

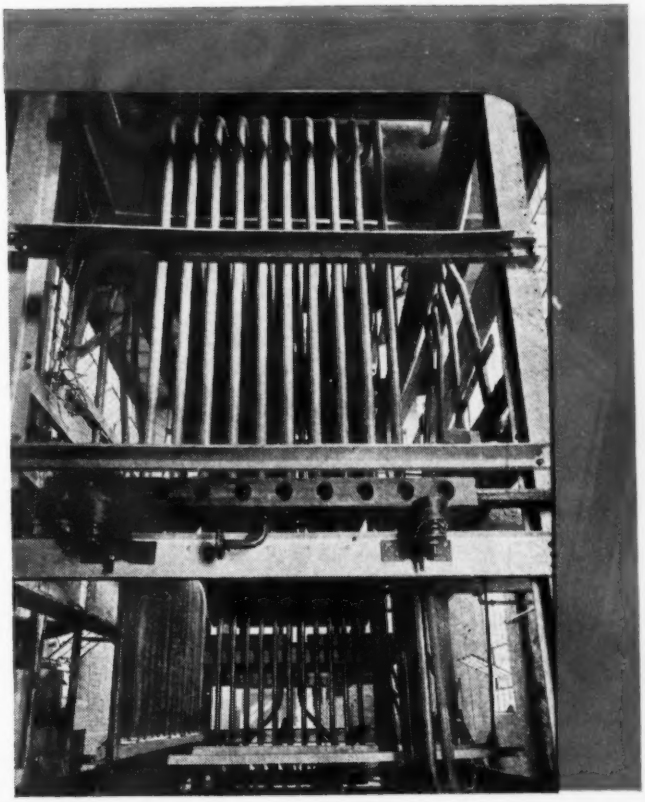
Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes are made by the most modern process of tube manufacture—a process which has undergone constant improvement since *first developed* by Republic Steel and Tubes Division.

Thus, these pressure tubes gain distinct advantages over tubes made by other methods. *They're new enough to be different.*

On the other hand, *they're old enough to be tried and proved.* Twelve years of service (more than 120,000,000 feet installed) in all types of steam generating and heat transfer equipment in practically every industry and under all conditions of operation have demonstrated *conclusively* that ELECTRUNITE Tubes are *SAFE, SOUND, EASY TO INSTALL AND ECONOMICAL TO USE.*

Companion products made by the same process —some 30,000 miles of Republic Line Pipe, 50,000,000 feet of oil well casing and tubing, and more than 1,000,000,000 feet of aircraft and mechanical tubing in carbon, alloy and stainless steels—add further proof of these qualities.

Republic ELECTRUNITE Tubes slide in freely and roll rapidly to tight joints—because they are *consistently* uniform in diameter, wall thickness and concentricity.



They expand, roll and bead with equal ease at original tube ends or wherever the tubes may be cut—because full normalizing provides uniform ductility.

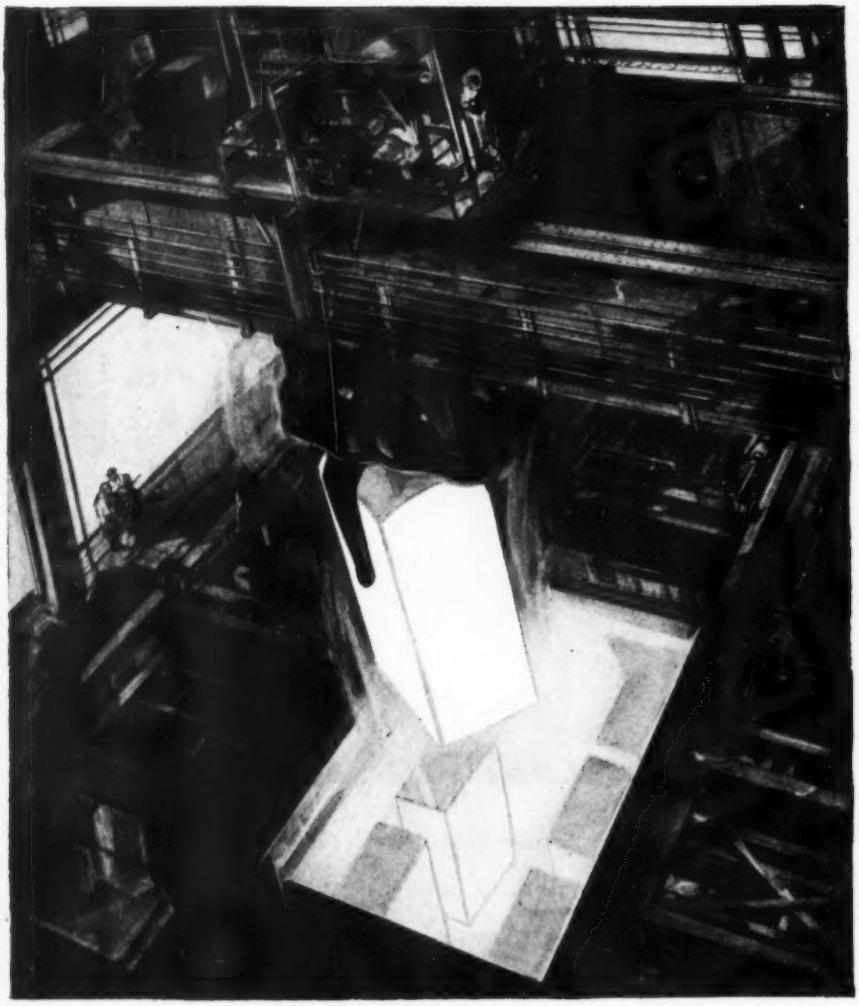
Uniform strength is insured by the most rigid tests. A smooth surface free from scale and scale pits retards the attack of corrosion.

What these tubes have accomplished in savings for others, they also can do for you. Write us for the complete story.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Berger Manufacturing Division
Culvert Division • Niles Steel Products Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York 17, New York

BE CAREFUL WHEN YOU DISCUSS WAR INFORMATION. THINK BEFORE YOU SPEAK.

Republic ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES



BAPTISM OF FIRE
FOR STEEL INGOTS

The baptism of fire that steel ingots receive in the great gas-fired furnaces, known as soaking pits, conditions them for further processing. It is one of the many applications of heat in the production of steel. For heat is the agent that reduces raw materials into iron, converts iron into steel, helps shape and finish steel into the infinite number of forms in which it serves.

In the manufacture of steel, great progress has been made in the study, analysis, and control of heat. The attention paid to the application of heat is as careful as that paid to the scientific determination of the materials used in producing steel, the most useful of metals—steel to arm our fighting men with superior weapons—steel in abundance for broader peace-time employment.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA

J&L STEEL

CONTROLLED QUALITY STEEL FOR WAR

SOAKING PITS

Holes in the ground were the first device for evenly distributing throughout the steel ingot, the heat from its molten interior to its solid exterior, to make it ready for rolling. John Gjers, Swedish-born steel engineer of England, in 1882, seeking to avoid time-wasting, costly practice of allowing ingots to cool and then reheating them to rolling temperatures, placed each ingot in a brick-lined, covered hole in the ground. These heat-retaining holes, forerunners of modern, complex steel ingot-heating furnaces, were called "soaking pits." The holes have long been obsolete, but the name lingers on.

Gjers' idea was successful from the start and the new practice spread from England to the Continent and to the United States within a dozen years. The Henry Bessemer medal was awarded Gjers in 1894 by the British Iron and Steel Institute "for great service" to the industry by his soaking-pit invention and other improvements in iron and steel production.

The baptism of fire given steel ingots today in modern, intricate, scientifically heat-controlled and skilfully tended ingot, heating furnaces, is a far cry from the holes in the ground put to use by the son of a Swedish army officer in England back in the 80's. The soaking of ingots in pits is one of the most important steps today in the march of steel from iron ore to finished product. Without soaking pits there could not have been the present record production of steel for war—90,000,000 tons last year in the United States, more than all the rest of the world.

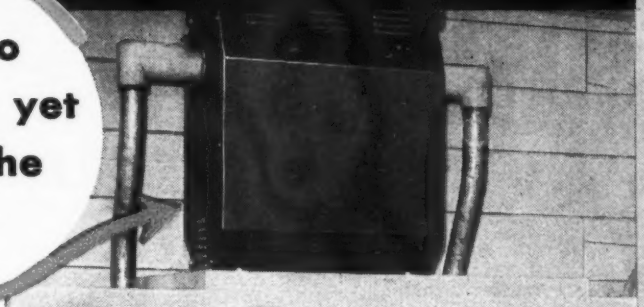
Shriller than a bo'sun's in a gale, is the whistle piercing the deep undertones of a steel mill that is the signal to start ingots coming up from the soaking pits to the blooming mill to be rolled into long blooms or wide slabs. After this first rolling, the steel passes on through other mills and other processes to wind up in many sizes, shapes and grades adaptable for manufacture of countless articles useful in peace, as well as war.

Only 15% of surgical instruments sold in this country before the war were made here. Now most instruments and hospital equipment for our armed forces are American made. The industry is producing about 60,000 tons of special steels for some 5,000 applications required by Army and Navy Medical Corps. This entailed learning how to achieve production of many highly specialized steels formerly imported from Europe.

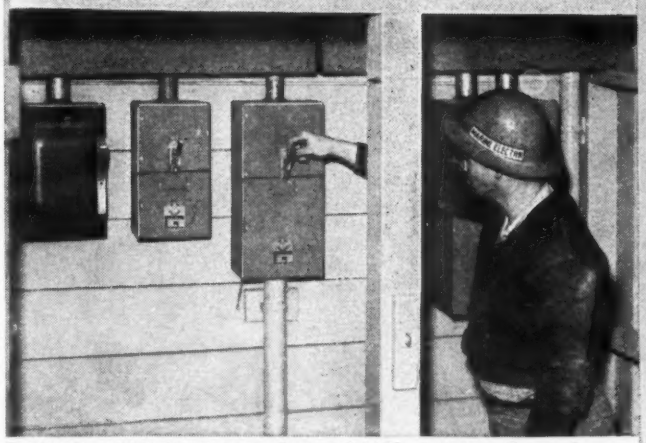
Conquering new horizons in metallurgy since World War I, American scientists have put the U.S.A. far ahead in production of better industrial steels, and in development of super-fine special steels. For example they have (1) Created new high temperature and corrosion-resistant steels for hospital and laboratory; (2) Helped make possible the mass fabrication of these steels into surgical instruments of unparalleled efficiency; (3) Materially aided vast life-saving developments within the pharmaceutical industry.

A COMPACT POWER SUPPLY RIGHT WHERE IT'S WANTED

Close to the load, yet out of the way



- ✓ NO OIL
- ✓ TOTALLY METAL ENCLOSED
- ✓ NO FIREPROOF VAULTS
- ✓ REMOTE MOUNTING UNNECESSARY
- ✓ NO LONG RUNS OF HEAVY COPPER



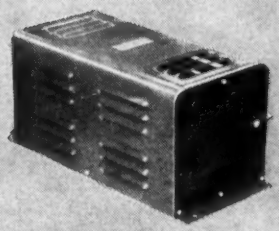
TUCKED AWAY UNDER THE EAVES at Kaiser Cargo, Inc., Shipyard No. 4, this 25-kva G-E dry-type transformer takes power from a 440-volt circuit and steps it down to operate 110- or 220-volt electric hand tools and lighting circuits, close by. The inherent safety that permitted it to be placed close to the load eliminated the need of long runs of heavy, expensive copper.

Installed right at the load, Type D transformers provide your equipment with the right voltage for its most economical operation. They are being used, profitably, from coast-to-coast in industrial plants to insulate one circuit from another and to boost or step down voltage for the most efficient operation of such equipment as motors, machine tools, welding apparatus, heat-treating furnaces, and high-current testing devices.

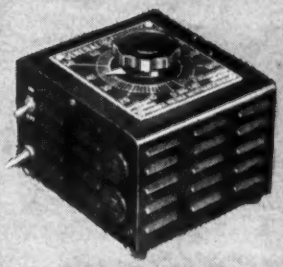
Stay cool; save space—Type D transformers are cooled by natural-draft ventilation. Their unique, drip-proof case, which incorporates a slanted-louver construction, aids the flow of ventilation air through the transformer coils. They can be placed against a wall or close to other units, with little or no effect on the temperature rise of the transformer. Because of this fact, considerable space can often be saved, especially when a number of these transformers are to be banked.

Easy to install; maintenance negligible—As these transformers are small, compact, and lightweight, they are easy to install on the floor, on the wall, or anywhere you wish. Either conduit or open wiring can be used. The ease of disassembly and reassembly of case parts permits quick inspection and cleaning, when necessary. But operating records show that little or no maintenance is required. Type D transformers are available in ratings up to 100 kva, 600 volts. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

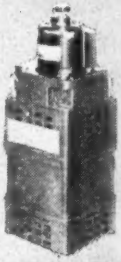
OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



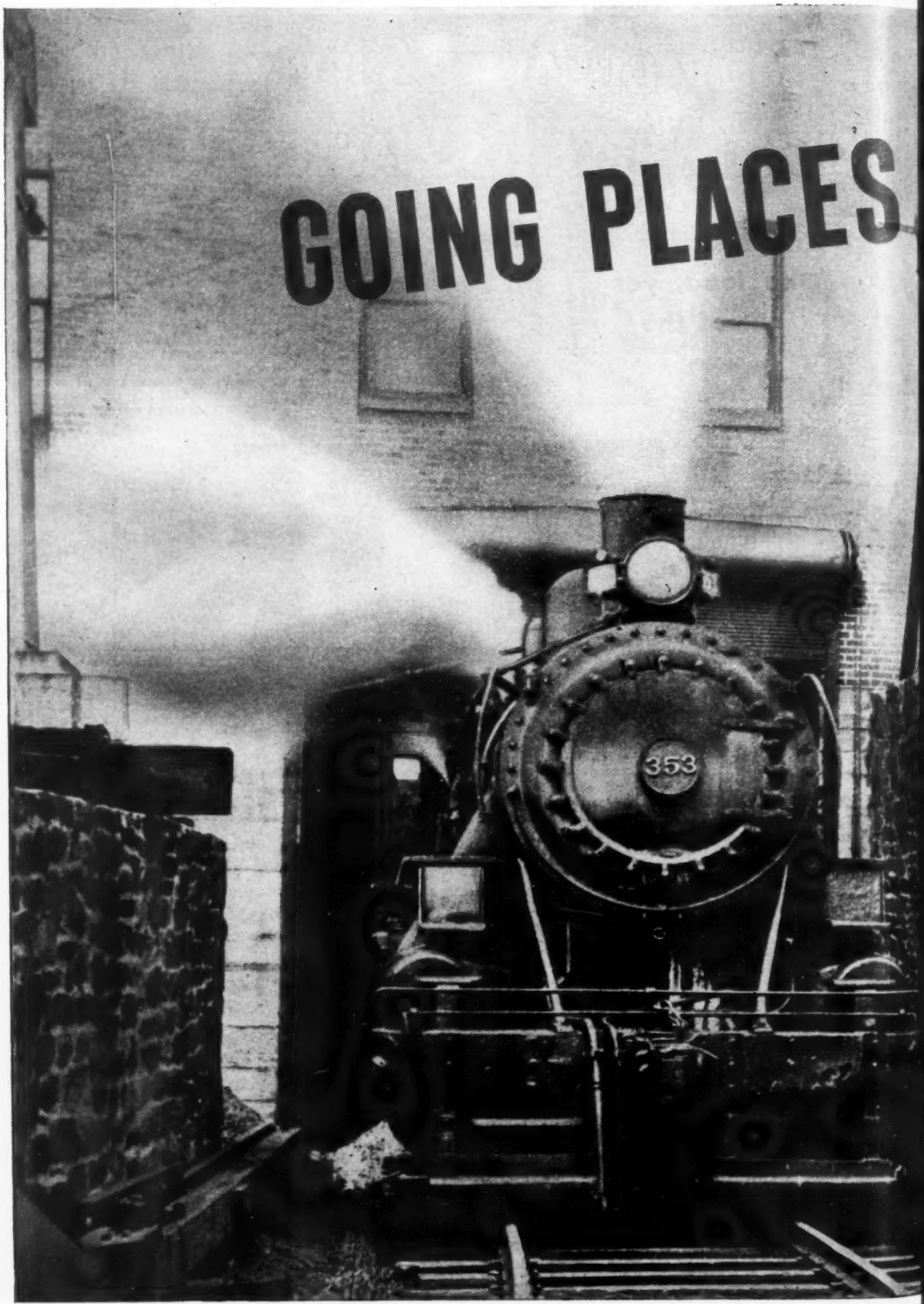
VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.



AIR-COOLED REGULATORS—Automatic type: for secondary circuits (10% regulation, raise and lower). Remote-motor or hand operated: for laboratory or testing (100% raise and lower). Ratings up to 12 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB BETTER

GENERAL ELECTRIC


GOING PLACES
353

STANDING STILL

WITH a full head of steam, this locomotive is doing a vital war job without even turning a wheel. The reason—it's pinch-hitting for a factory boiler under repair.

However, keeping steam plants in continuous 24-hour operation requires more than ingenuity. Operators everywhere find they can get full-time, full-power output from their reciprocating engines by using Texaco steam cylinder oils.

Whatever the steam temperature or pressure, in engines old or new, there is a Texaco steam cylinder oil that will atomize completely, adhere to cylinder walls, separate rapidly from exhaust; assure quiet operation and low oil consumption.

Texaco lubricants have proved so effective in service, they are definitely preferred in many fields, a few of which are listed below.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 E. 42nd St., New York 17, N. Y.

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

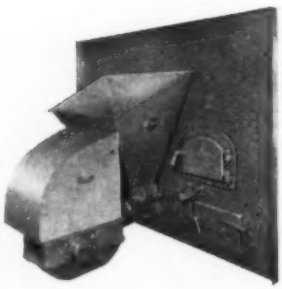
TEXACO

TEXACO

STEAM CYLINDER OILS

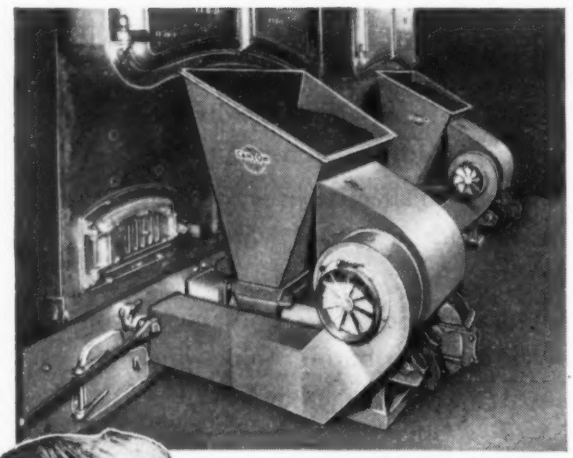
FOR EVERY STEAM CONDITION

HERE'S WHY HUNDREDS OF PLANTS PURCHASED CANTON LO-SET . . .
THE HEAVY DUTY RAMFEED STOKER



A FRONT OF FURNACE VIEW of a fully assembled Canton LO-SET. All vital parts are protected by trim enclosures that add modern lines as well as safety.

SIDE FURNACE VIEW of Canton LO-SET installation showing the air slot arrangement in the Tuyeres. Coal burning efficiency is obtained by the gradual decrease in number and size of openings toward the side ash dumps, so that the fuel bed receives less and less air as combustion becomes more complete.



Euclid Road Machinery Co., Cleveland, Ohio

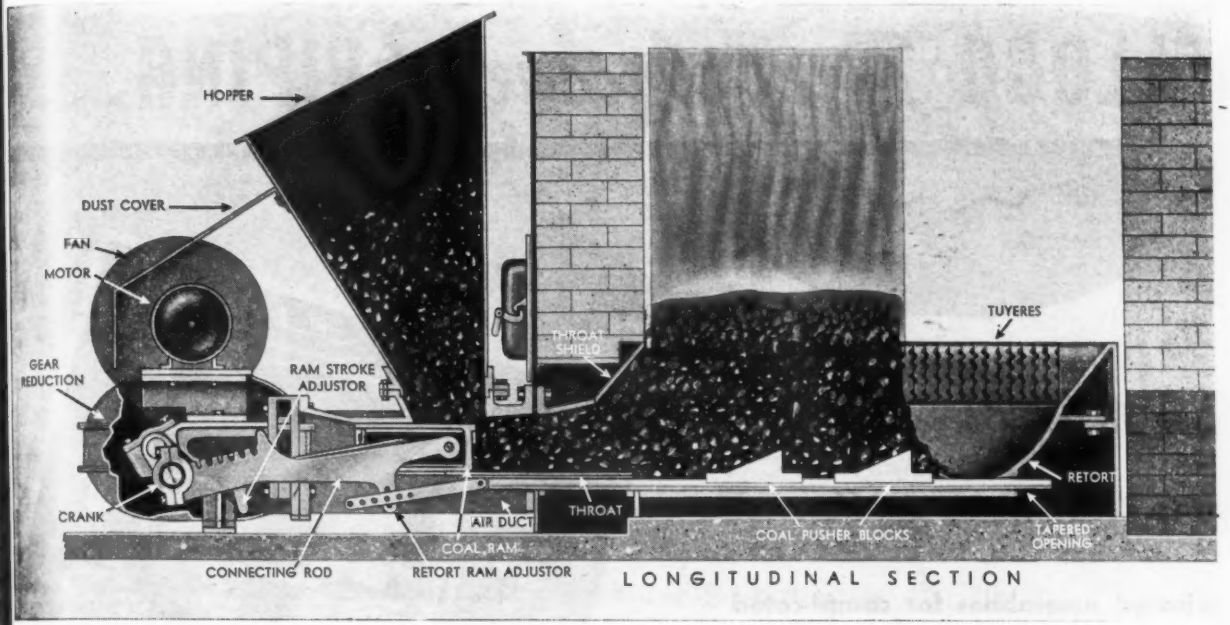
TYPICAL LO-SET INSTALLATION—Two Canton LO-SETS get high praise for maintaining ample steam pressure under all load conditions—no maintenance problems and fuel savings have topped expectations.

CANTON STOKERS

PARTICULARLY ADAPTED TO HIGH FIRE-BOX STEEL BOILERS

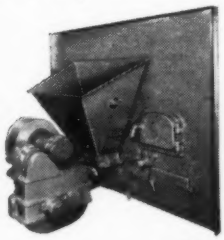
The LO-SET Stoker is one of Canton's 54 types and sizes for needs up to 800 H. P. Ruggedly constructed, it meets severe service demands. The firing efficiency means many dollars in fuel and manpower savings. Hundreds of schools, buildings, industrial plants, laundries, dairies, greenhouses, hospitals, hotels and other steam plants are experiencing LO-SET'S trouble-free performance . . . backed by Canton's FIVE YEAR GUARANTEE.

. . . AND HERE'S HOW YOU CAN MAKE LARGE SAVINGS IN FUEL— AND GET MAXIMUM EFFICIENCY!



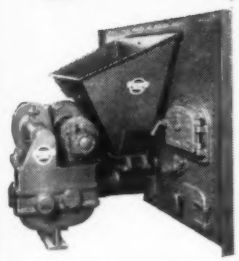
The longitudinal section view of a Canton LO-SET illustrates the feeding and coal burning method. Very little power is required as the gear reduction and drive are engineered to handle the maximum load easily — even wood, slate or small pieces of foreign matter are crushed and fed into the furnace without stoppage. Note the positive Ram Feed action and leveling blocks in the retort which distribute the fuel and help break up coke formations.

THE *Only* STOKER GUARANTEED 5 YEARS!



THE UNIFLEX DRIVE

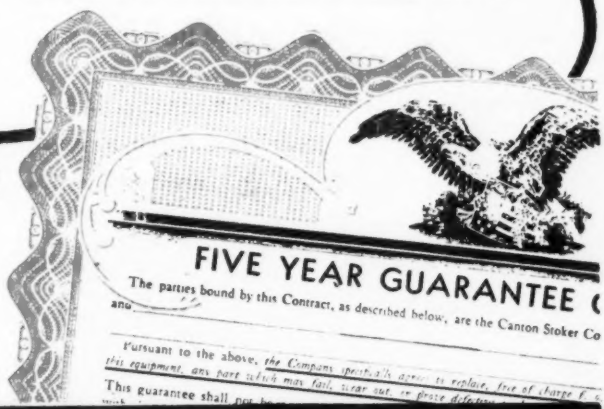
Available for LO-SET installations is this compact drive arrangement designed for limited space. Note in photo (housing removed) the compact yet flexible assembly. The Uniflex provides independent stoker and fan control yet permits synchronized operation.



UNIFLEX STEAM DRIVE

Here's the same compactness as the electric Uniflex drive. Desirable where electric power is not reliable or if exhaust steam can be used advantageously for heating purposes.

SEND FOR COMPLETE DATA


FIVE YEAR GUARANTEE
The parties bound by this Contract, as described below, are the Canton Stoker Co
and
Pursuant to the above, the Company specifically agrees to replace, free of charge f. o.
this equipment, any part which may fail, wear out, or prove defective
This guarantee shall not be

CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

Gentlemen:

---Please send all descriptive literature at once

---Have a CANTON Engineer interview us immediately

Name _____

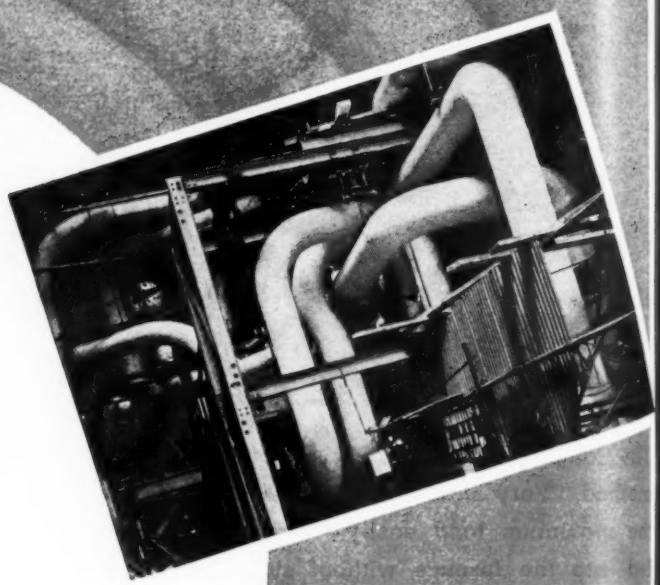
Company _____

Address _____

City _____ State _____

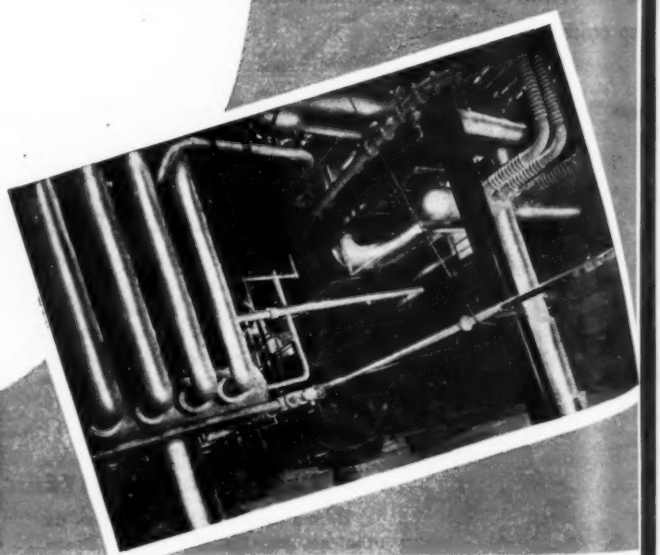
KELLOGG *Prefabricated* PIPING...

... Saves Time... Overcomes many complicated piping problems



Prefabricated assemblies for complicated piping systems designed with the aid of the KELLOGG Scientific Method of Determining Moments and Forces Electrically solve the most complex and highly specialized temperature and pressure requirements of public utility, process and marine power plants.

Consulting engineers and operators of central stations, industrial and marine power plants find that placing the entire responsibility of difficult piping installations with The M. W. Kellogg Company offers a satisfactory solution to their problems.



KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

LOS ANGELES 609 SOUTH GRAND — TULSA PHILTOWER BLDG

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research, development and operating experience throughout the world are incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

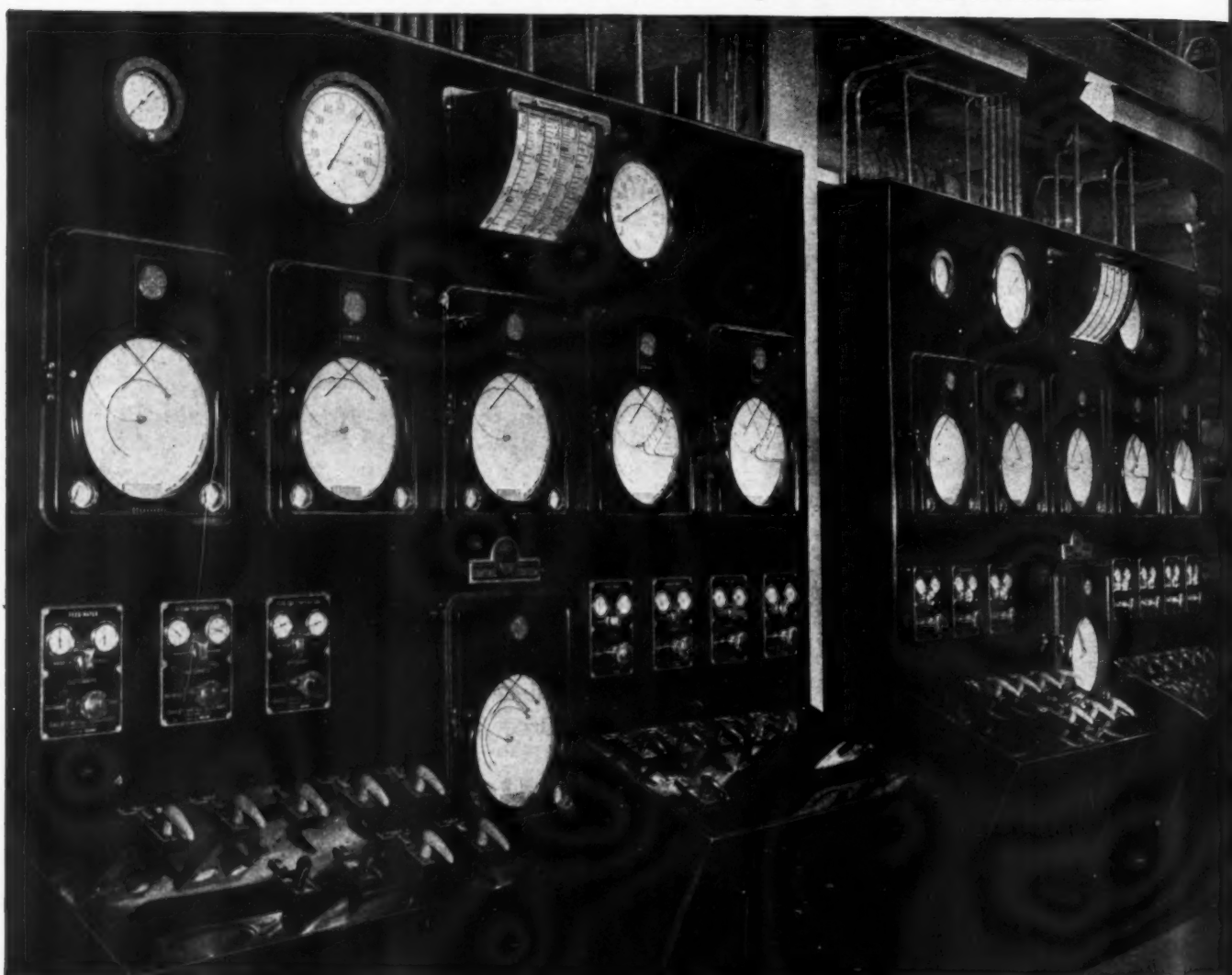
405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

MORE THAN

AND

Bailey Boiler Control Panels for two 135,000 lb. per hour capacity, oil and gas-fired boilers in a Western Power Station



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHE

METERS

CONTROLLERS

A Bailey Boiler Control System is more than just a group of meters and controllers recording and controlling certain factors in the boiler plant. It is a means of improving plant operation from the standpoints of:—

1. Continuity of service **3. Steaming capacity** **5. Safety**
2. Fuel conservation **4. Conservation of manpower**

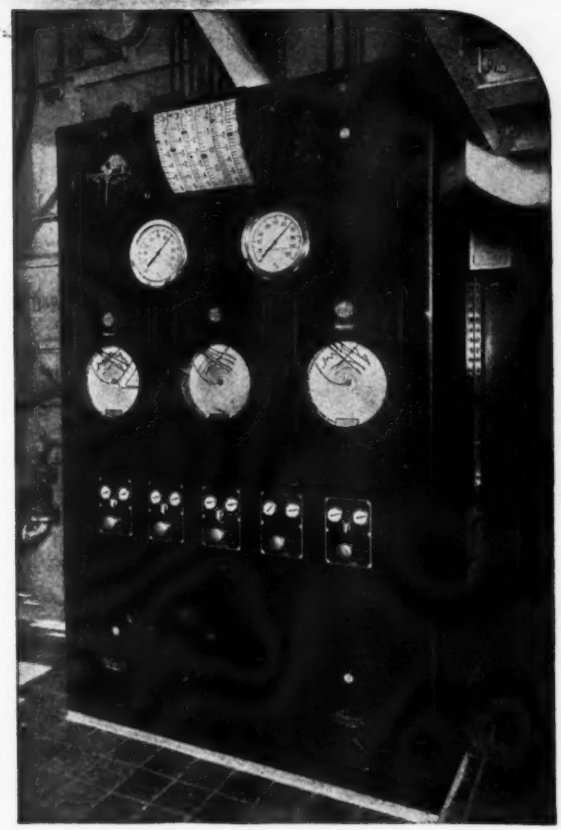
Bailey Control Systems are effective because each system is carefully engineered to the requirements of the unit which it serves. The experience gained from thousands of successful combustion control installations serves as a basis for this engineering service which starts with the selection of equipment and continues through the design, construction, calibration, installation and final adjustment on the job.

Engineering work is done in the user's plant by Bailey Field Engineers who have been thoroughly trained in combustion and automatic control practice. These engineers are stationed in over 30 industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

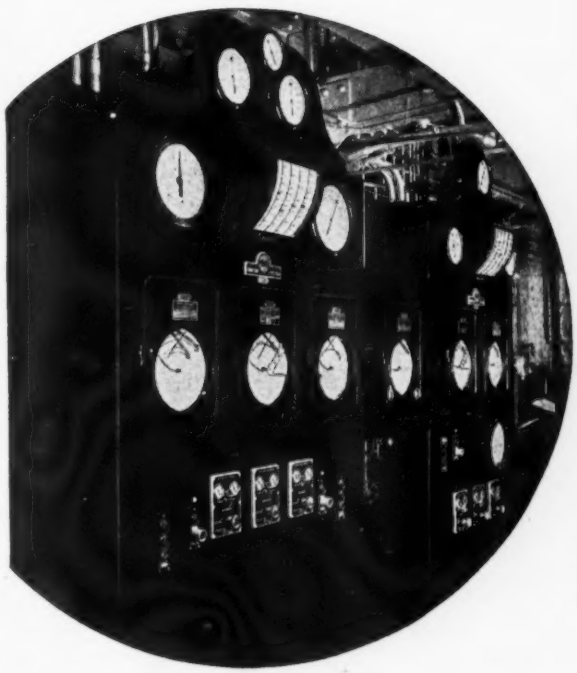
The Bailey engineer in your community has a wide background of combustion engineering know-how at his command. It includes the records of tests on thousands of boiler installations covering a wide range of fuels, furnaces and fuel-burning equipment. He has more to offer than meters and controllers. He is primarily interested in helping you to secure optimum operating conditions in your plant.

G-19

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada



Bailey Boiler Control Panel for 100,000 lb. per hour capacity Integral-Furnace Boiler



Bailey Boiler Control System in an Eastern Paper Mill

The Complete Combustion Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

So Simple, So P

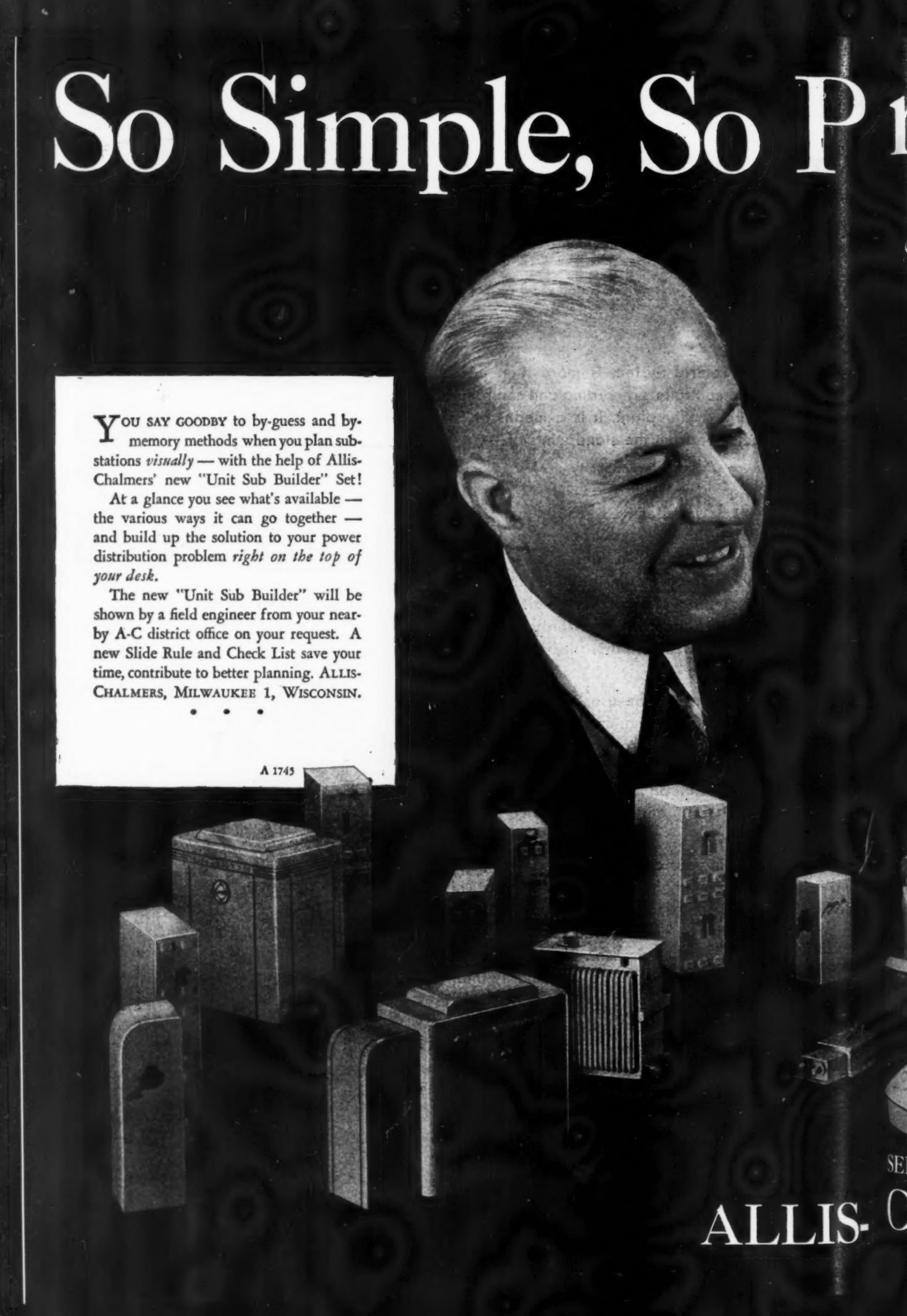
YOU SAY GOODBY to by-guess and by-memory methods when you plan substations *visually* — with the help of Allis-Chalmers' new "Unit Sub Builder" Set!

At a glance you see what's available — the various ways it can go together — and build up the solution to your power distribution problem *right on the top of your desk.*

The new "Unit Sub Builder" will be shown by a field engineer from your nearby A-C district office on your request. A new Slide Rule and Check List save your time, contribute to better planning. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

A 1745

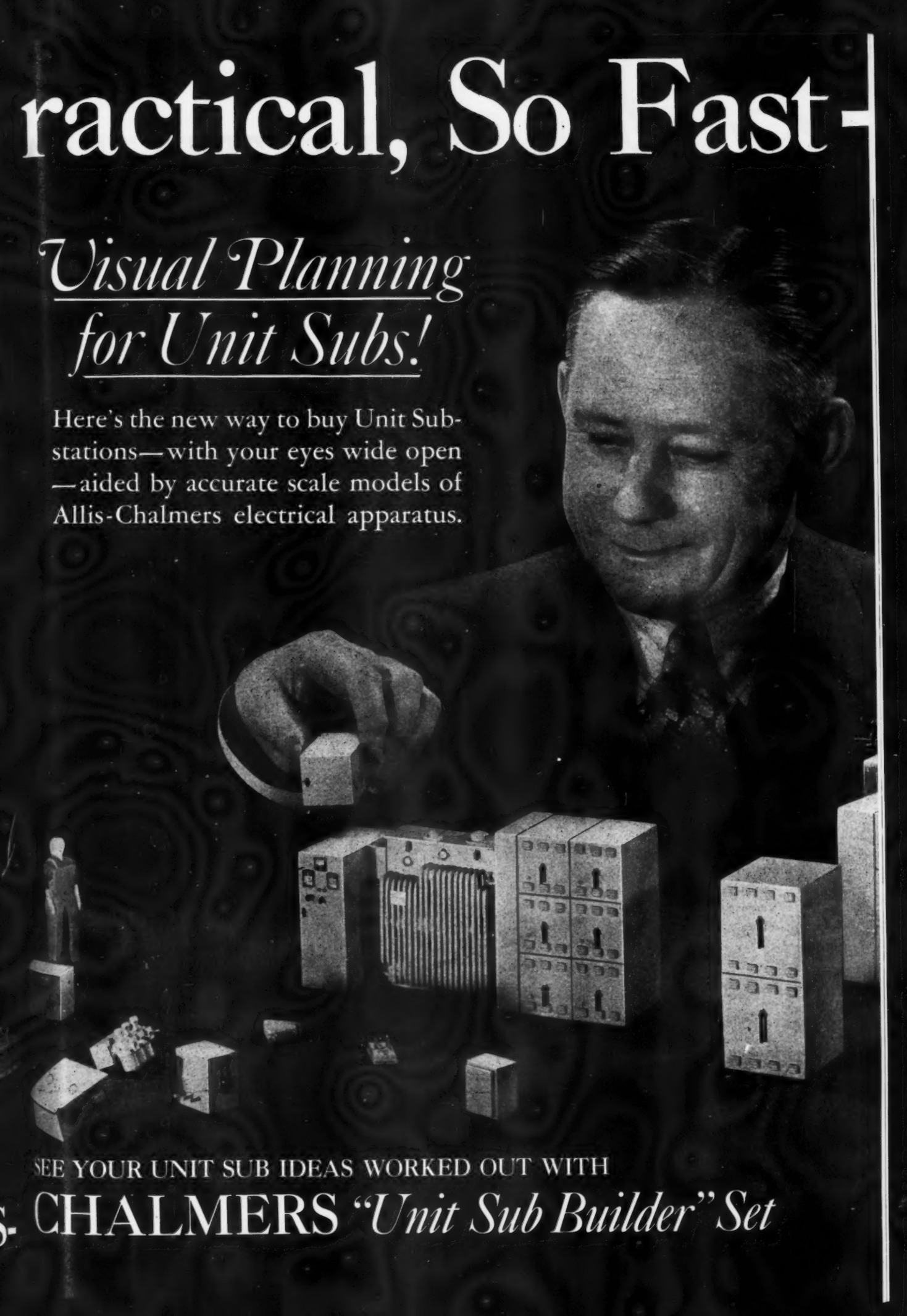


ALLIS-

ractical, So Fast-

Visual Planning for Unit Subs!

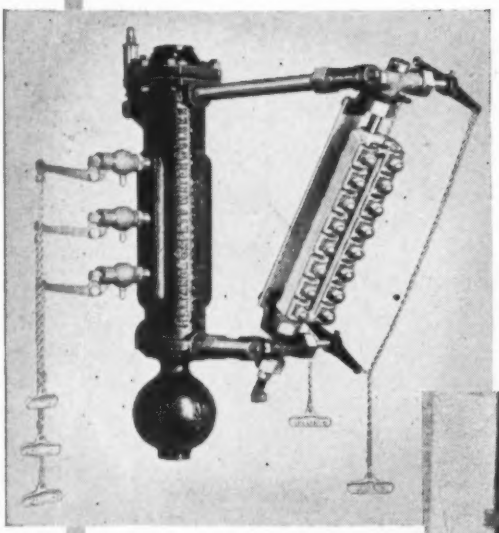
Here's the new way to buy Unit Substations—with your eyes wide open—aided by accurate scale models of Allis-Chalmers electrical apparatus.



SEE YOUR UNIT SUB IDEAS WORKED OUT WITH

S. CHALMERS *"Unit Sub Builder" Set*

Plan to have RELIANCE SAFETY TEAM Water Level Supervision

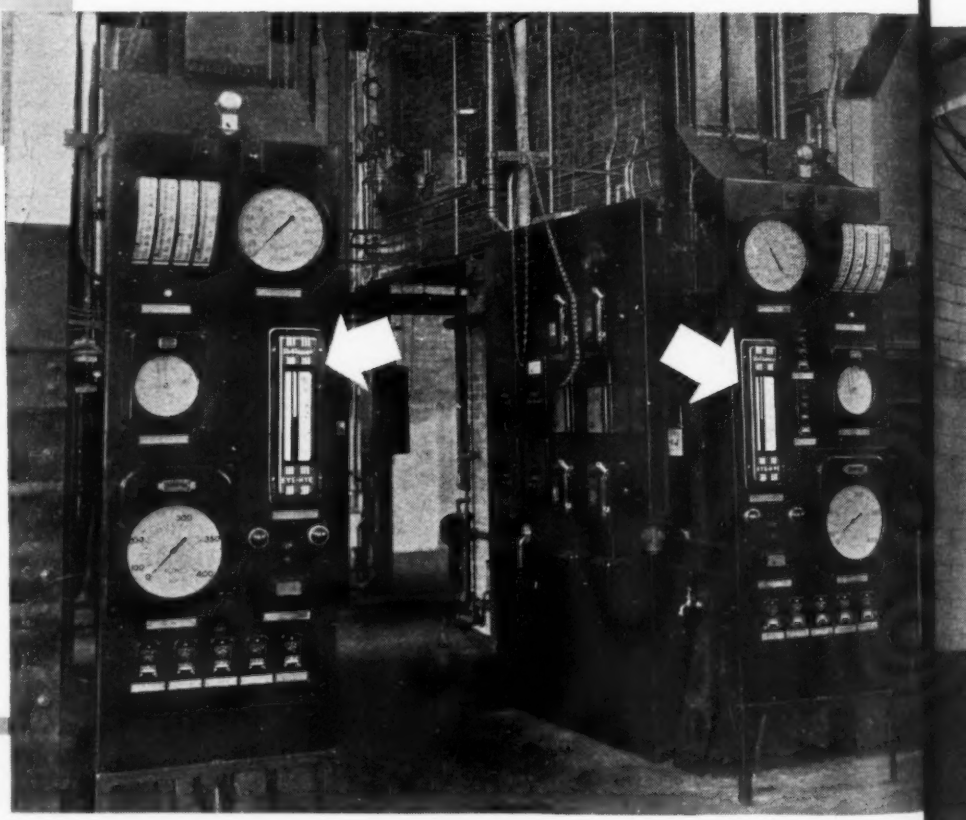


for more efficient boiler operation .. more capacity .. lower power cost

Reliance ALARM Water Column equipped with TILT-VIEW Gage assembly for easier access to gage reading at the boiler.

☆

Two EYE-HYEs on panel boards at the U. S. Dept. of Agriculture Regional Laboratory at Wyndmoor, Pa. Reliance ALARMS similar to the one above complete the Safety Team installations.



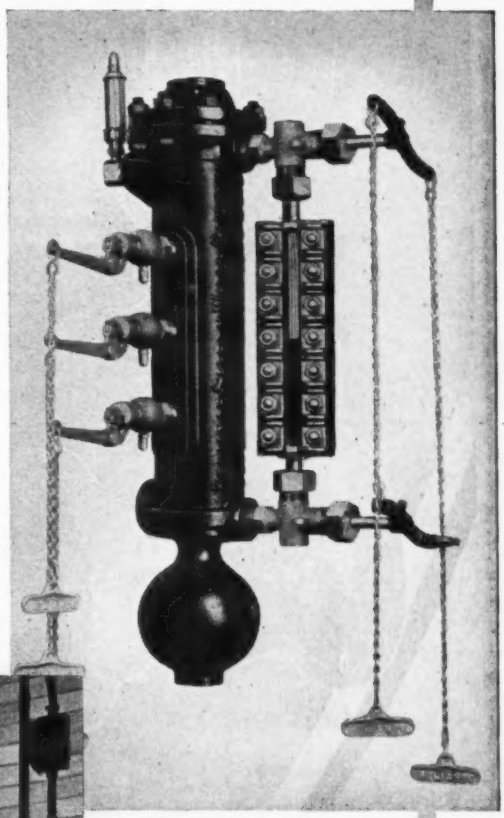
60 Years of Boiler Protection

1884-1944 Reliance

● You men who shoulder the responsibility in the power plant will agree that every means of guarding against power failure is justified — today and always. Make sure your boiler water levels are checked unfailingly. Plan now to arrange for Reliance Safety Team SOUND and SIGHT check — *dependable* supervision facilities that help you guard against dangerous or inefficient boiler water levels.

Up on the boiler drum the Reliance ALARM sounds instant warning when water levels go too high or too low — by shrill whistle or by electric signals. EYE-HYE carries the true water level reading, in a brilliantly illuminated green indicator, to convenient positions on the boiler room floor. It's seen at a glance, saves time, induces more frequent reading.

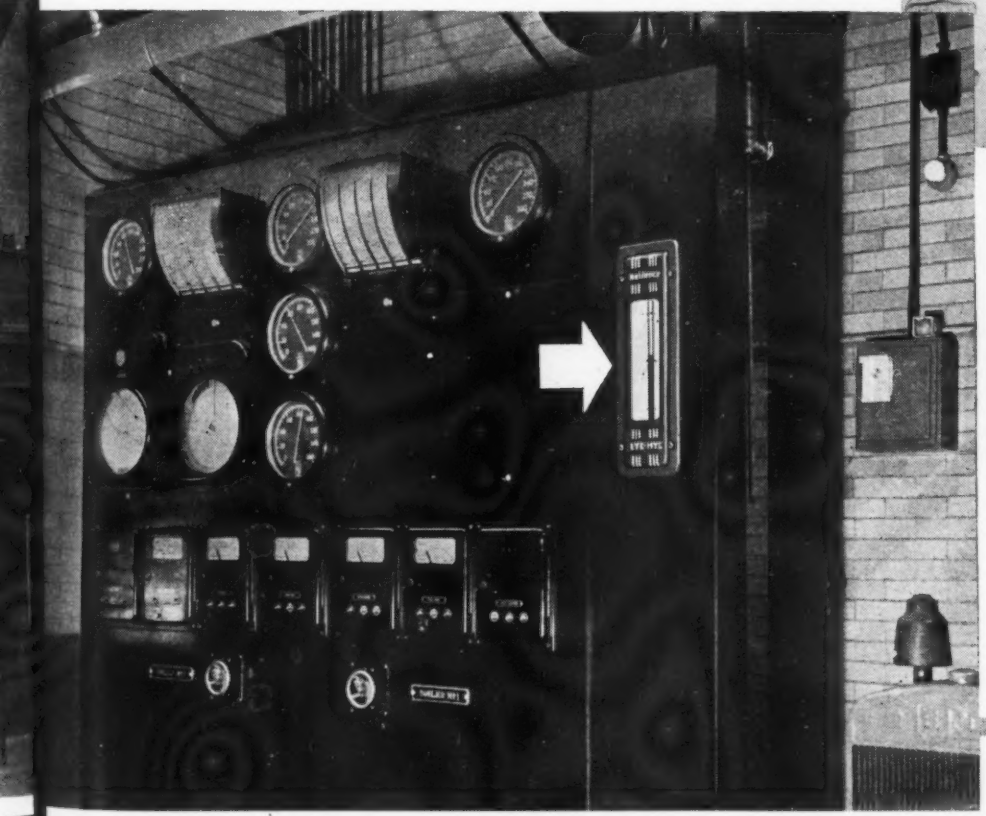
Don't take chances on power failure when Reliance Safety Team will give you the means of adequate water level supervision. And better supervision helps you to keep fuel costs down, gives you more capacity through consistent operation. Write for free ALARM and EYE-HYE bulletins.



Popular type Reliance ALARM for pressures to 250 lbs., equipped with Reliance PRISMATIC Gage Insert. Full range of models for all pressures.

☆

Modern panel at the Cleveland plant of Westinghouse Electric & Mfg. Co., showing installation of Model E-13 EYE-HYE — part of Reliance Safety Team of which ALARM style above is a part.



BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

★ Buy More War Bonds ★

LUNKEN H

Spell L

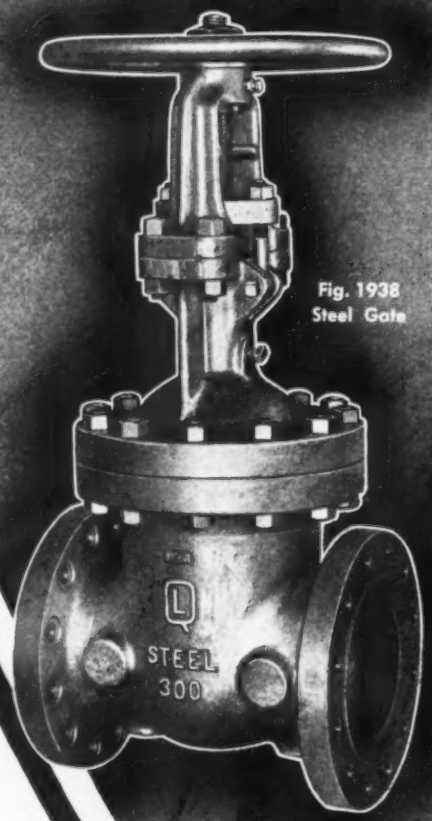


Fig. 1938
Steel Gate

Fig. 1430
Iron Body Gate

Fig. 1640
"King-clip" Gate

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 7

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

SIMPLICITY OF DESIGN MEANS EASIER MAINTENANCE

HEIMER VALVES
Low Maintenance"

Long service life and low maintenance have ever been the goal of Lunkenheimer design. Ask users why they prefer Lunkenheimer Valves and their answer is universal—"they're built to last and give the least amount of trouble."

These staying qualities are particularly important when production is running at previously unheard-of tempos—when "time out" is figured in loss of vitally needed equipment, rather than mere dollars. Lunkenheimer Valves are helping many a maintenance crew do a better job easier.

Illustrated are just a few of the many types of valves in the Lunkenheimer line—bronze, iron, steel and corrosion-resistant alloys—for all prevailing pressures and temperatures.

Your Lunkenheimer distributor is always ready to help you with your maintenance, repair and operating problems. His facilities are at your call.

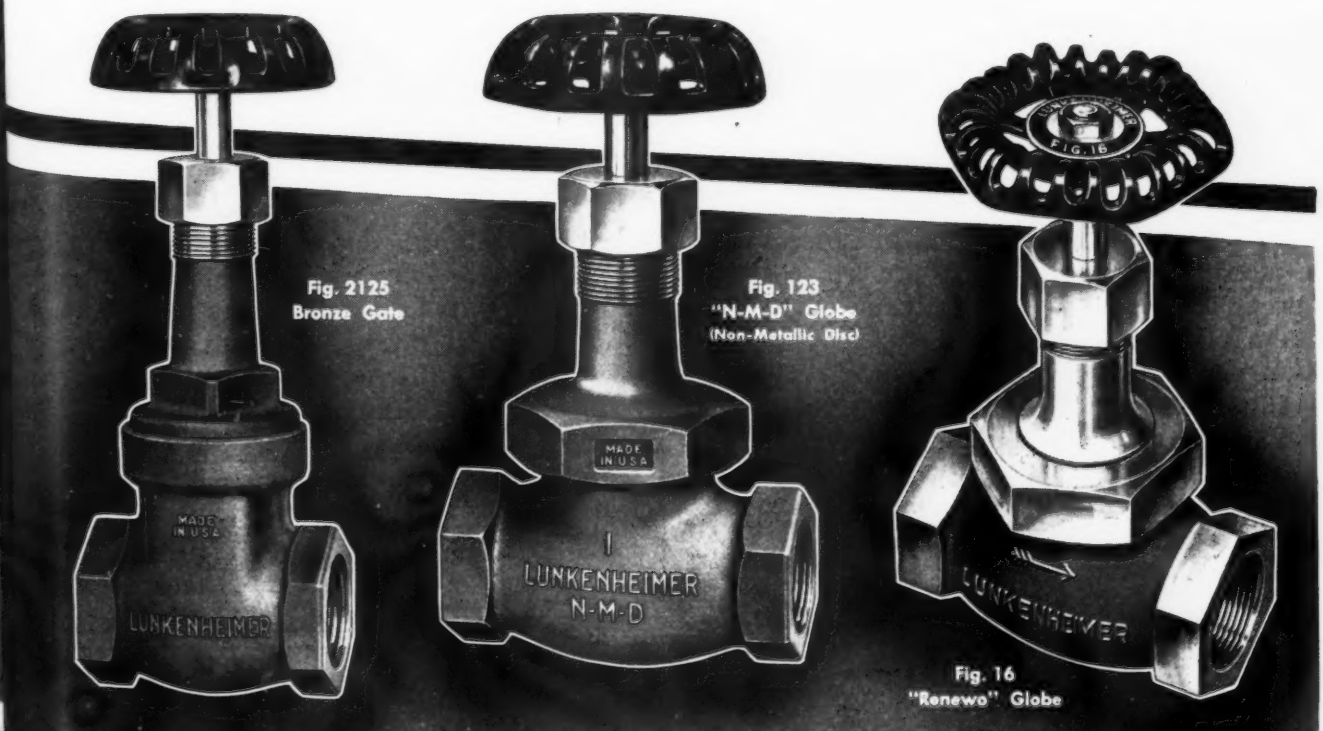


Fig. 2125
Bronze Gate

Fig. 123
"N-M-D" Globe
(Non-Metallic Disc)

Fig. 16
"Renewo" Globe

RONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

CAN YOU PUT

Your Finger

ON POTENTIAL TROUBLE SPOTS BEFORE THEY HAMPER PRODUCTION?

✡

EVERY power plant or process is a chain of equipment elements in which some "weak link" may limit the capacity or its failure cause a shut-down of the entire plant. Can you put your finger on these potential trouble spots as they develop, before they get into the emergency class and disrupt production schedules?

Flow meters are bloodhounds for spotting faulty conditions as soon as they occur. An installation of boiler and distribution meters will enable you to track down these potential trouble spots long before they have a chance to become serious. This is of prime importance where the plant load is putting severe demands on both equipment and personnel.

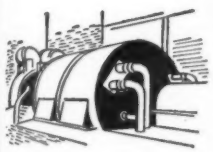
Power engineers in hundreds of industrial plants have found that the data made available by an intelligently engineered metering system has enabled them to increase the *de-*

REPUBLIC INSTRUMENTS AND CONTROLS

pendable capacity of their plant by spotting and fixing weak links before they fail—and to increase the *effective capacity* of their plant by eliminating all unnecessary consumption of steam, water, compressed air, etc.
Here are a few typical examples:

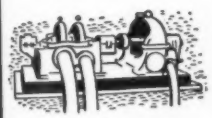
You can't improve conditions until you know what the conditions are.

TURBINE TROUBLES?



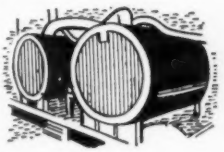
About a year after a turbine had been installed, difficulty was experienced in meeting the steam demand at certain times. Since this trouble had never arisen before, faulty operation of the turbine was suspected. Before deciding to overhaul the turbine, an expensive procedure, a Republic flow meter was installed on the turbine steam line. This meter instantly revealed that the turbine was operating within 2% of the performance guarantee and that the real trouble was in the steam generating plant. Here it was found that two of the units were delivering only 60% of their rated output. The data provided by the flow meter prevented an unnecessary turbine overhauling and placed the blame where it belonged.

PUMP TROUBLES?



When a battery of six process water pumps failed to operate at full capacity it was necessary to dismantle them one by one to locate the trouble. This procedure required two weeks to find out what an installation of flow meters could have revealed in two seconds. Of course, there was only one answer—Republic meters now measure the discharge from each pump.

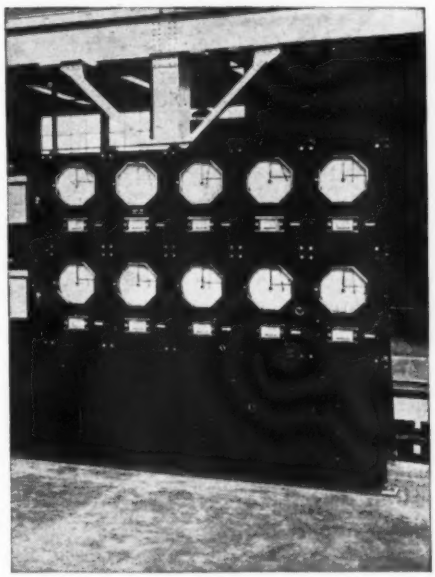
EFFECTIVE CAPACITY?
By studying steam and water flow meter records, a process plant found it possible to shut down a triple-effect evaporator completely and draw liquor of the same strength from an intermediate stage of a quadruple-effect evaporator. This change saved approximately 100,000 lb. of steam per day. Thus the effective capacity of the boiler plant was increased by this amount.



Hundreds of similar experiences recorded in our files provide overwhelming evidence of the value of Republic meters.

A COMPLETE METERING SERVICE

The Republic Flow Meters Co. offers nationwide evidence of the preference shown by industrial leaders for Republic flow meters. Whether it be in the steel industry, paper industry, chemical industry or other major industries, you will find an impressive number of Republic flow meters measuring the distribution of steam, water, gas and air.



What does this leadership mean to you? Briefly, this: when you decide—as you eventually will—to take full advantage of the assistance modern instruments can render, a statement of your aims to Republic will make available an unmatched experience, a complete range of instruments and alternative schemes to choose from. One of our engineers will be glad to call at your request, without any obligations on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

The TERRY

GRABBING A

This 1500 KW Terry unit is equipped with the Terry solid one piece wheel. The buckets, as shown above, are milled from the solid metal. There are no parts to work loose. • • • The blades have large clearances and are further protected by the projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. • • • End play can do no damage to the blading as the side clearance is very large (about one inch). There is no end thrust since the steam enters and leaves the wheel in a direction at right angles to the shaft. • • • Such sturdy rotor construction makes for long life and low maintenance.

The quick starting Terry alternator unit, shown right, is installed in a completed West Coast station. Normally, the station iliaries are supplied with power from a house service former. During periods system frequency or in failure of the house servi auxiliary load is taken o the Terry unit.

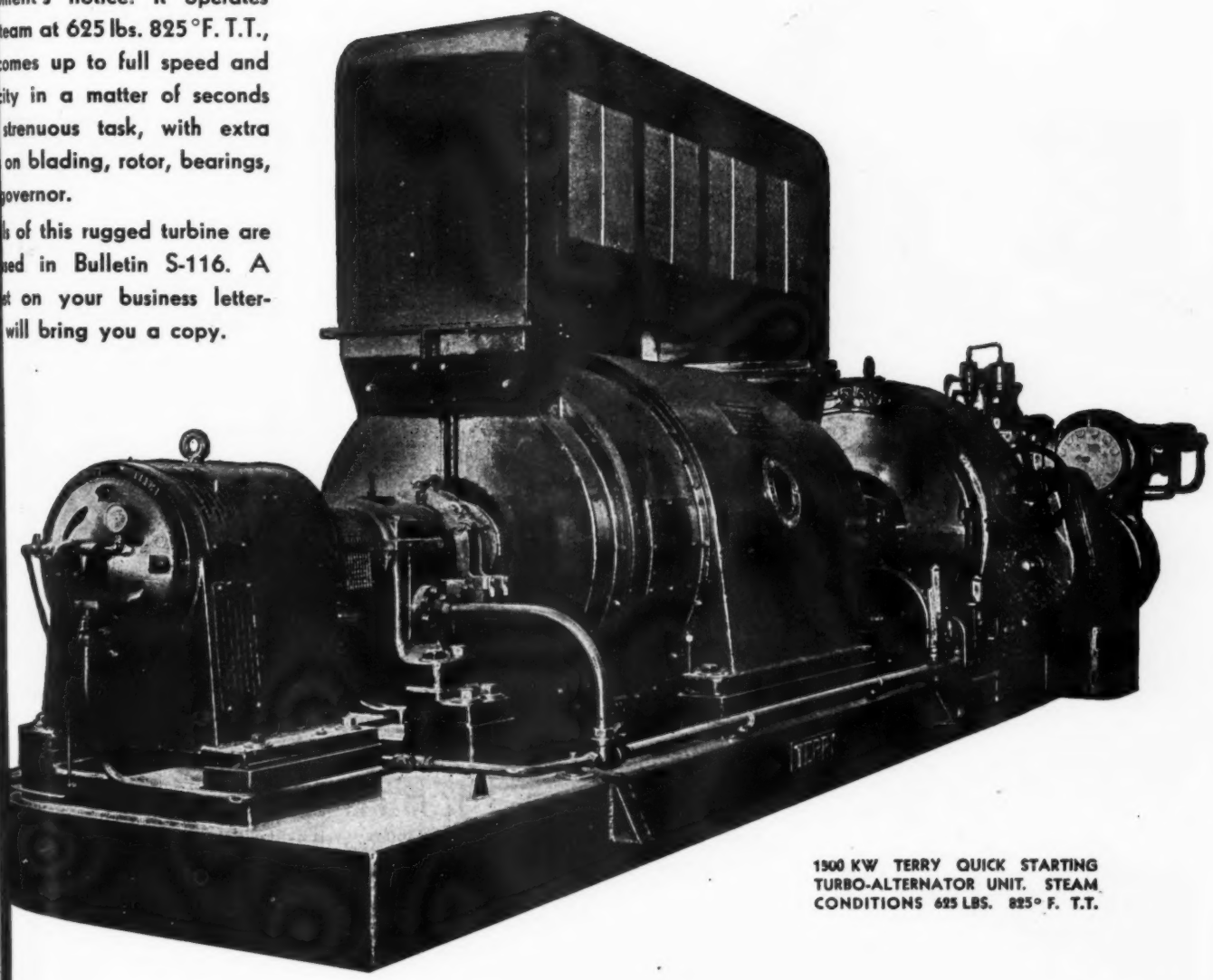
THE TERRY STEAM TURBINE CO.

Wheel Turbine

1500 KW LOAD ON A MOMENT'S NOTICE!

nit is ready to take over on oment's notice. It operates team at 625 lbs. 825°F. T.T., comes up to full speed and city in a matter of seconds strenuous task, with extra on blading, rotor, bearings, governor.

ls of this rugged turbine are ued in Bulletin S-116. A t on your business letter- will bring you a copy.



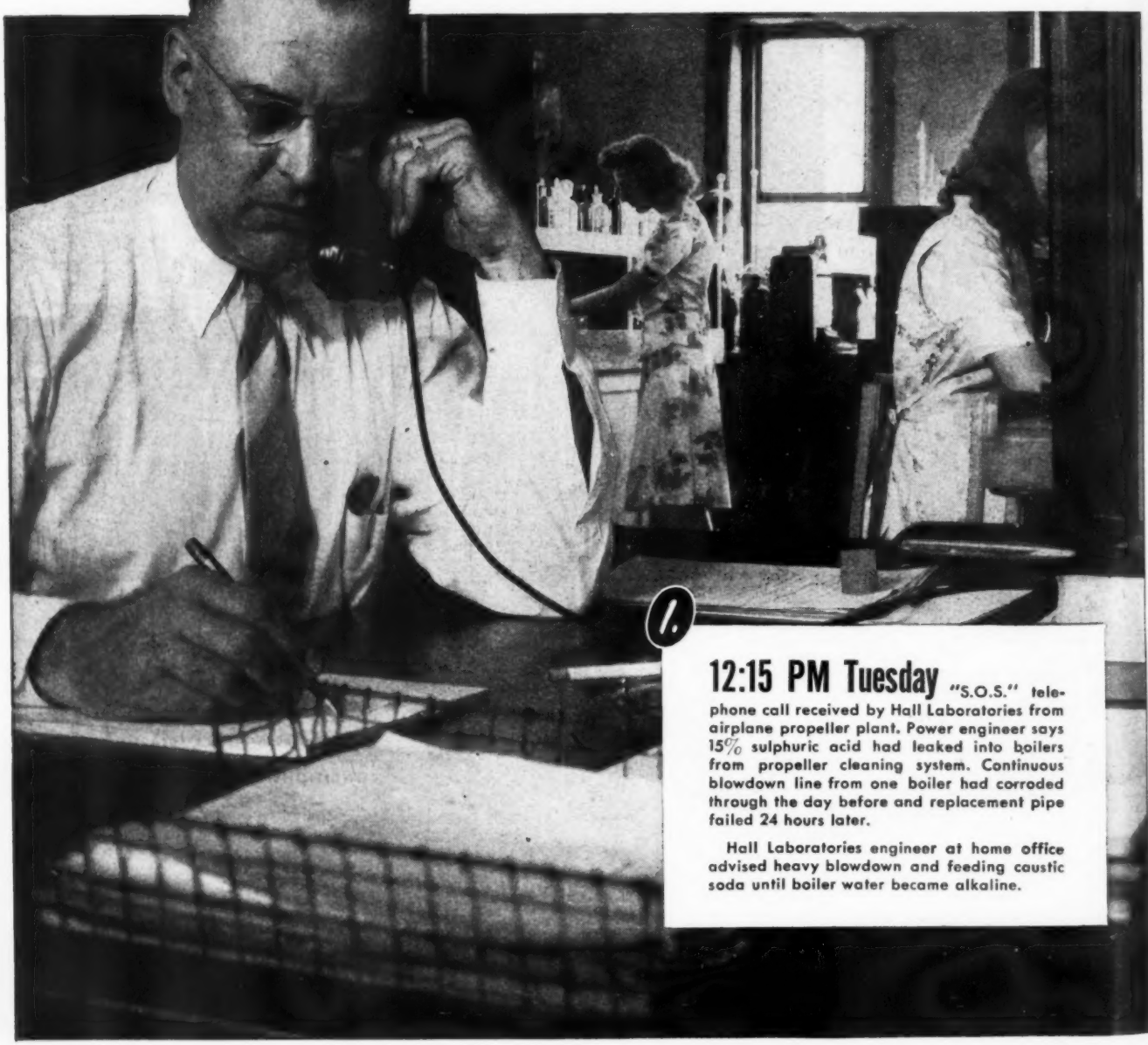
1500 KW TERRY QUICK STARTING TURBO-ALTERNATOR UNIT. STEAM CONDITIONS 625 LBS. 825° F. T.T.

T-1150

TERRY SQUARE - HARTFORD, CONN.

Sulphuric acid in boilers threatens shutdown of propeller plant

Quick action by Hall Service Engineers saves vital war production boilers



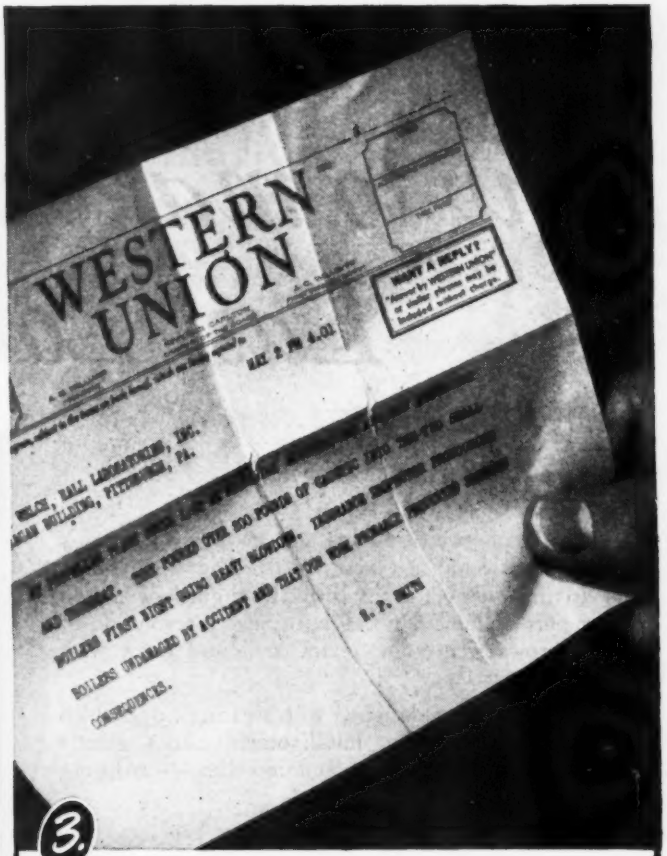
1.

12:15 PM Tuesday "S.O.S." telephone call received by Hall Laboratories from airplane propeller plant. Power engineer says 15% sulphuric acid had leaked into boilers from propeller cleaning system. Continuous blowdown line from one boiler had corroded through the day before and replacement pipe failed 24 hours later.

Hall Laboratories engineer at home office advised heavy blowdown and feeding caustic soda until boiler water became alkaline.

2.

1:30 PM Hall Field Service Engineer was located and instructed to get to propeller plant as soon as possible as boiler condition appeared serious enough to warrant shutting down boilers.



3.

4:00 PM Friday Telegram from Hall Service Engineer to home office: "At propeller plant until 1:00 AM Wednesday morning and all day Wednesday and Thursday. They poured over 200 pounds of caustic into the two small boilers first night using heavy blowdown. Insurance inspector pronounced boilers undamaged by accident and that our work probably prevented serious consequences."

THIS case history shows that, in addition to their regular work of trouble prevention, Hall Service Engineers are available and able to cope with the unexpected emergency. This is a decided advantage when added to the benefits of *Preventive Care*.

Hall *Preventive Care* is the natural and obvious remedy for unscheduled outages—the practice of scientific supervision to prevent boiler troubles due to all kinds of scale from calcium carbonate to silica, and to corrosion, embrittlement and carryover. There is no substitute for this constant scientific supervision. When the unexpected does occur, however, the Hall Service man can give you the benefit of his own experience plus that of the men who are responsible for many of the most important developments in boiler water conditioning.

HALL LABORATORIES · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN HALL BUROMIN CALGON

HALL SYSTEM *of Boiler Water Conditioning*

Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

How to make IMPELLERS Last Longer . . .

CLEARANCES between moving and stationary parts in a centrifugal pump are very small. And when pump and its driving motor are not correctly aligned or weight of piping puts undue strain on casing, every revolution of the shaft throws tremendous extra load and extra wear on all moving parts.

In the case of pumps designed with wearing rings which are attached to the casing, misalignment causes greatly accelerated wear on both rings and impeller — reducing the effective life of both.

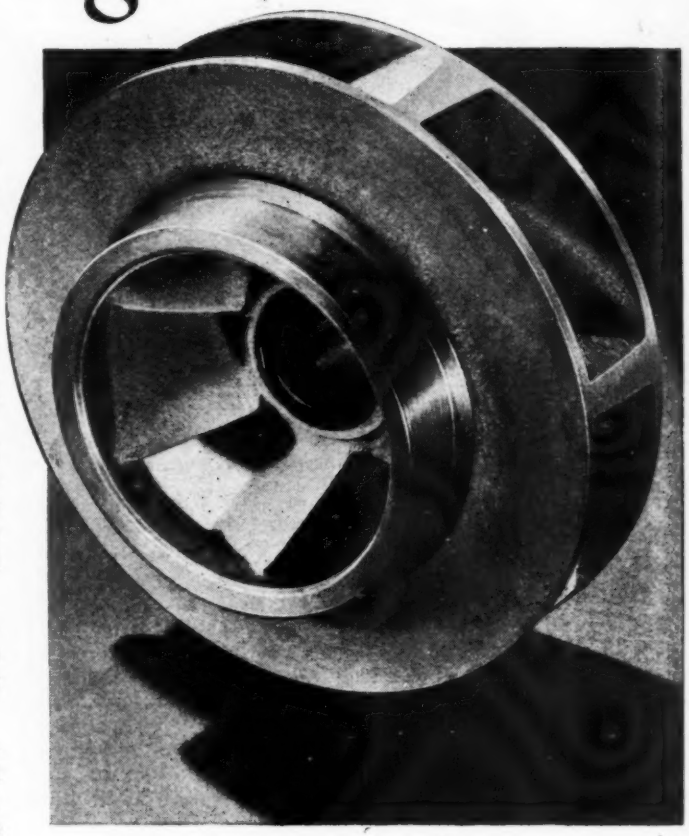
In an effort to eliminate the misalignment problem, A-C engineers developed, for many applications, the "Electrifugal" pump — in which *both* impeller and motor are mounted on *one* shaft and in *one* frame. In such a pump the elements cannot get out of line. Result: wear on all moving parts is greatly reduced.

Besides misalignment, there are still other factors contributing to impeller wear. Regardless of type of pumps you have, here are a few tips which can help you get longer life out of impellers . . .

▸ An often overlooked cause of impeller wear is cavitation. For if pump capacity, speed, head and suction lift aren't figured properly, cavitation can eat an impeller away fast. Here's what happens: Rapid movement of impeller blade through liquid produces a cavity behind blade; local high pressure increase drives liquid into metal with terrific force! Moral: Be sure head is right for your pump.

▸ If foreign matter is being sucked into your pump it can clog or wear impeller unduly. Where this condition exists, provide the intake end of suction piping with a suitable screen.

▸ When you dismantle your pumps (at least once a year), inspect impellers. If they are damaged or blade sections are corroded replace them, but *first* make a thorough search into the possible *causes* for the condition.



Impellers for Allis-Chalmers "Electrifugal" pumps are supplied in bronze, stainless steel, monel metal or other materials — depending upon the *exact nature* of the liquid to be pumped.

▸ If you haven't already done so, send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". This valuable booklet is packed with worthwhile information. Applies to *all* makes of pumps; contains *no* advertising. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1688

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.

Up where sawmills have to be flown in . . .

Bowser Engineered Fueling Systems

Installing airports and fueling systems on the route to Alaska operated by Northwest Airlines for the Army Air Forces, was a tough job. The route was largely through such primitive country that ground transportation was useless. For instance, a 24-bed hospital was flown in. So was a sawmill. That gives you an idea of the problems.

Bowser Aviation Fueling Systems were chosen for three major reasons . . .

1. In airport operations in many countries, working under all extremes of conditions, Bowser Systems have proved superior in the delivery of clean, dry, safe fuel.

2. Bowser designs and builds systems to meet virtually every special requirement.

3. Bowser-built equipment has established records for dependability and efficiency in hundreds of industries over scores of years.

Airport fueling systems are a specialized field, of course.

Bowser is equally widely known for its specialized lubricating equipment for the Power industry—turbine oil conditioners, filters and force feed lubricators, for instance.

Operating tests, conducted by impartial experts, have shown that oil, if kept perfectly clean, remains as good as new. Bowser Pressure Filters, working under severe power plant operating conditions have demonstrated their ability to keep oil clean and efficient much longer, thus prolonging the life of the equipment and saving money.

This is important, too—wherever you're located, there's a complete Bowser service organization close to you. BOWSER, INC., Fort Wayne 5, Ind.

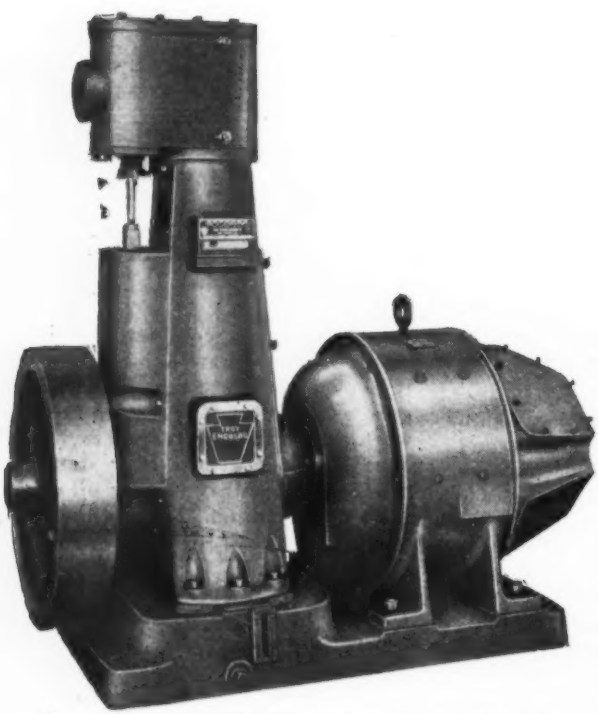
Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.

BOWSER ESTABLISHED 1885

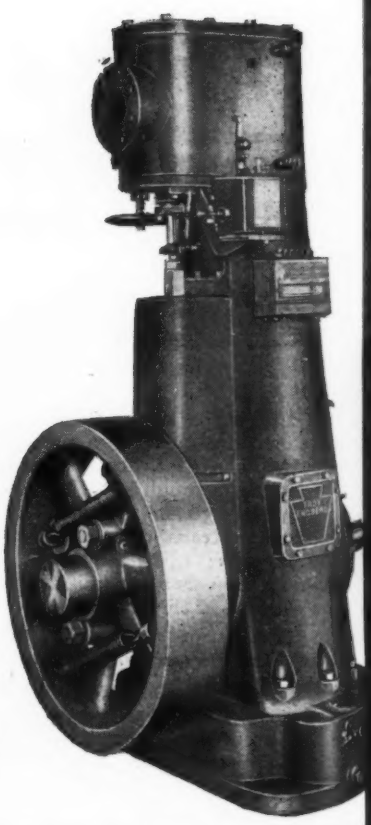
The Name That Means EXACT CONTROL of Liquids

TROY-ENGBERG STEAM ENGINE

TROY
ENGBERG



Troy-Engberg DC Generating Set such as used in plants equipped with DC motors and with lifting magnets; AC Generating Sets also available



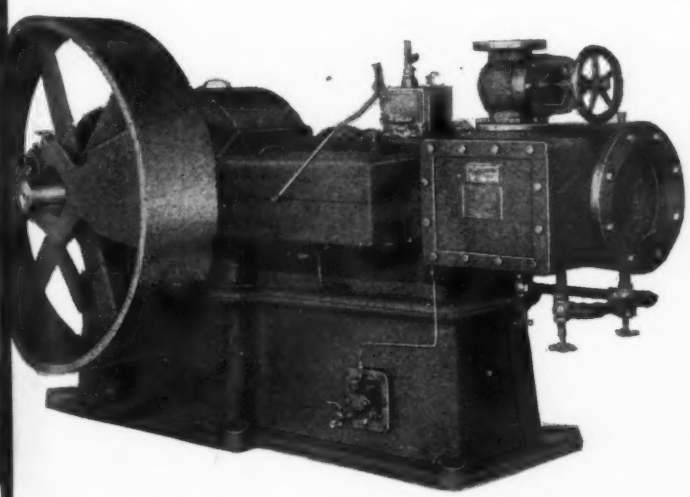
Troy-Engberg Steam Engine, piston valve, automatic governor. Engines with flat valves and throttling governors also available

TROY

THE STANDARD BY WHICH BY-PRODUCT POWER IS MEASURED

Troy-Engberg Steam Engine Power is By-Product Power. The engine is the standard by which by-product power is measured. If you can use all or most of the engine's exhaust steam for heating or processing in the place of live steam, your power immediately becomes exceptionally low-cost power. Many a Troy-Engberg Engine has paid for itself in a year or two. And since it is not at all unusual for these engines to run steadily for fifteen or twenty years without need for major repairs, it is easy to see what an excellent investment they make.

Study your plant and look for two things . . . equipment that needs a drive such as a pump, compressor, stoker, fan or generator; and a place to use the exhaust steam of the engine for heating or processing. Find that combination and it is probable that the Troy-Engberg Engine will produce the cheapest power.

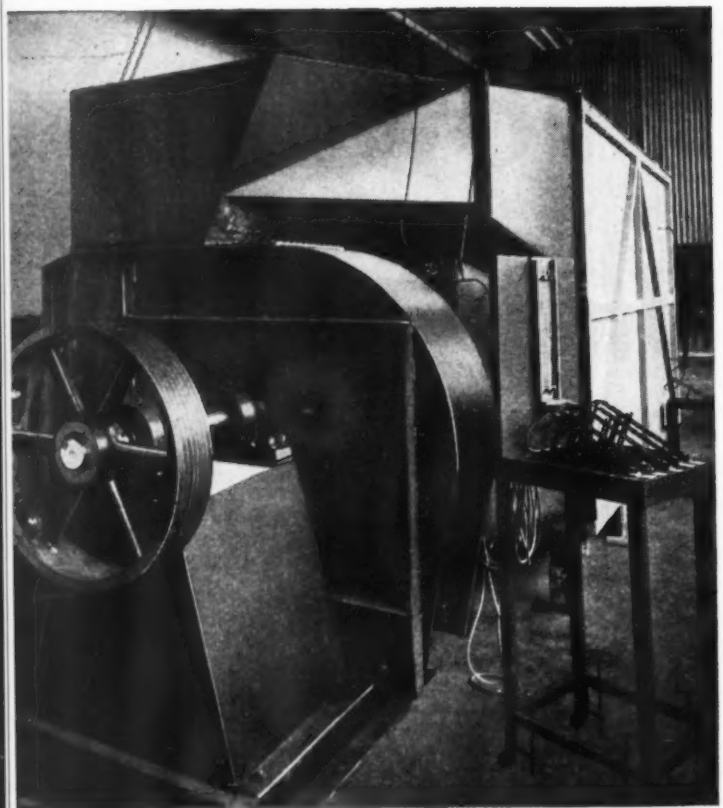


Troy-Engberg Horizontal Type Engine with automatic governor. This is one of several horizontal types

TROY
ENGINE & MACHINE CO.
Established 1870
1494 Railroad Avenue Troy, Pennsylvania

ENGBERG

Progress and Power in the



test conducted in the American Blower research laboratory to determine the air flow and resistance of a dehydrogenation catalyst case.

Tremendous progress has been made in the rubber industry. New developments . . . new processes . . . new synthetics . . . entirely new plants.

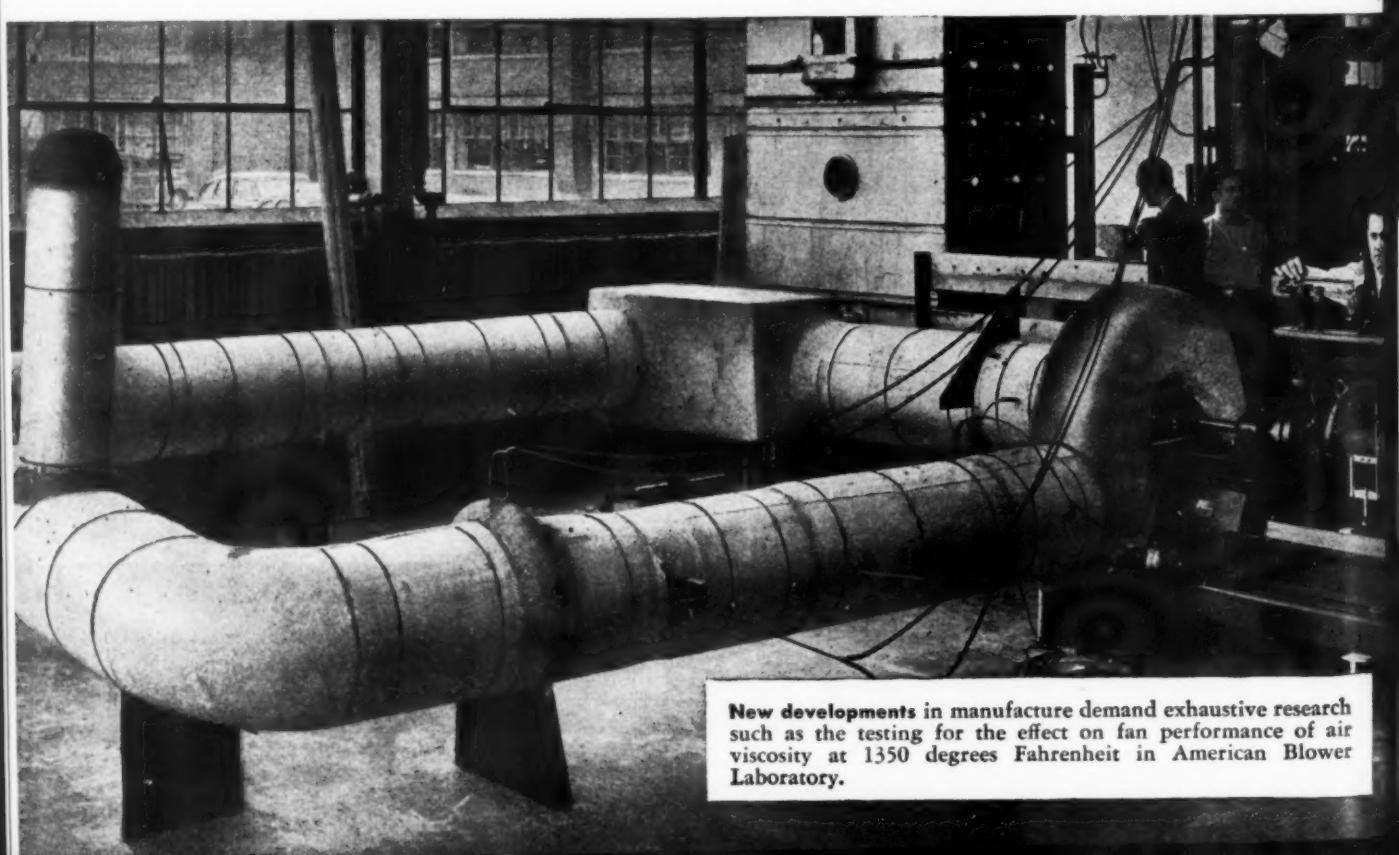
Behind this seemingly impossible task lies a story of co-operation — close co-operation on the part of machinery manufacturers and co-operation on the part of America's great Public Utilities in furnishing the added power to produce the goods.

American Blower co-operated by conducting exhaustive research studies and developing special air handling and conditioning equipment to withstand the grueling conditions of a greatly expanded rubber industry. Our knowledge gained through the years, building standard as well as specialized air handling equipment for industry, is available to you.

AMERICAN BLOWER

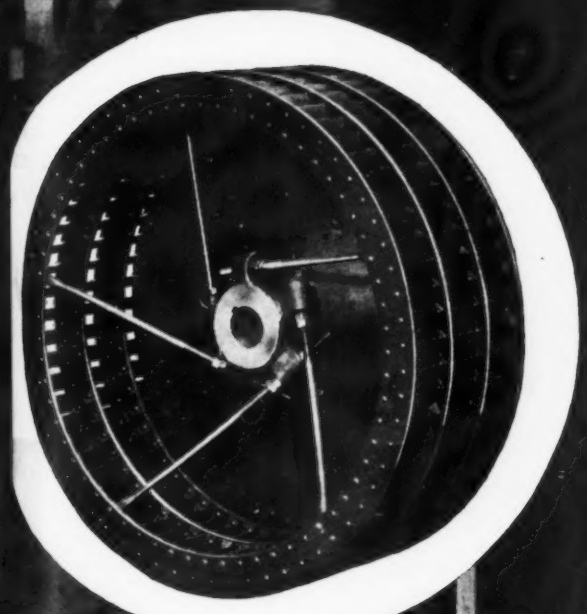
ARMY E NAVY
For Production "Well Done"

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
Division of American Radiator & Standard Sanitary corporation



New developments in manufacture demand exhaustive research such as the testing for the effect on fan performance of air viscosity at 1350 degrees Fahrenheit in American Blower Laboratory.

UBBER INDUSTRY



Stainless Steel Sirocco Wheels built by American Blower are designed to withstand the extremely high temperatures encountered in the manufacture of synthetic rubber.

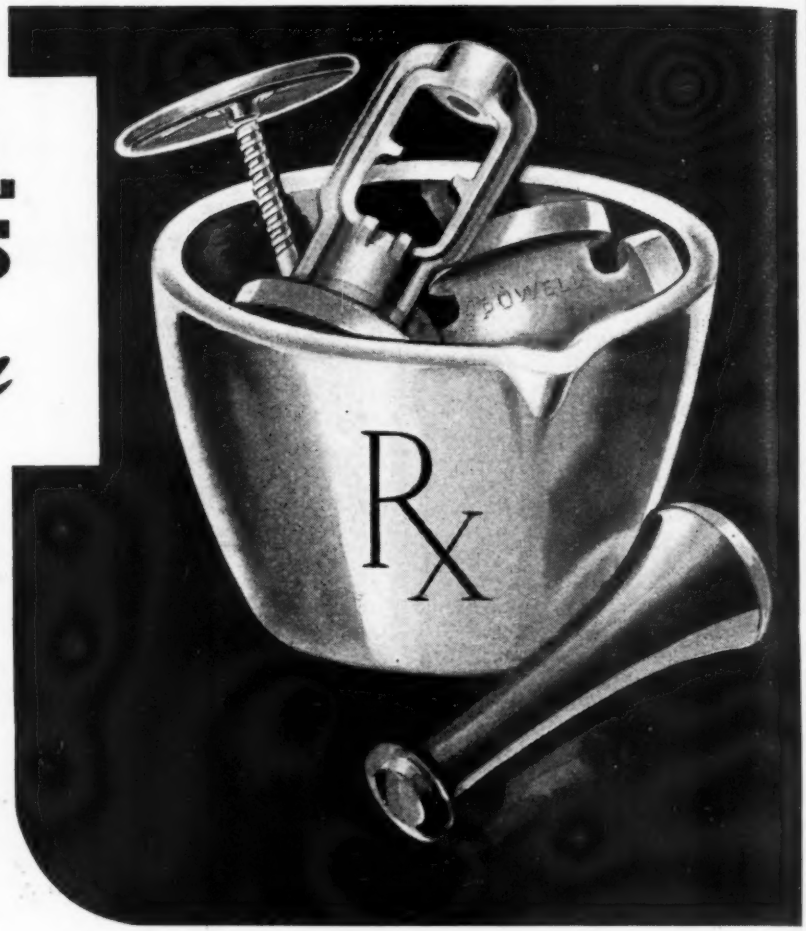
One of 64 Stainless Steel Jacketed American Blower Fan Housings for one of the largest synthetic rubber plants in the world. These fans circulate air up to 1350 degrees Fahrenheit in the process.

★ ★ ★ ★ ★

POWELL VALVES

by prescription

★



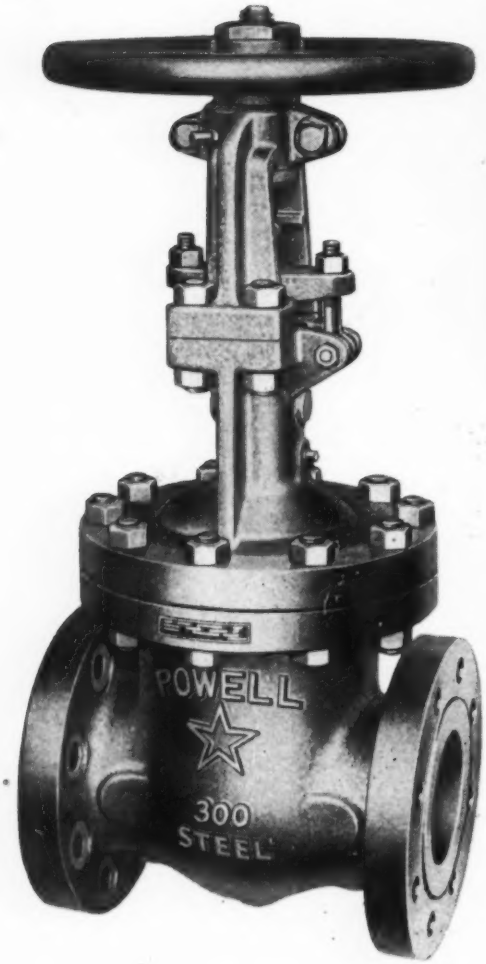


Fig. 3003—Class 300-pound Cast Steel Gate Valve, with flanged ends, outside screw rising stem, bolted flanged bonnet, two-piece yoke and taper wedge solid disc.

"Doctor-book" treatment is of dangerously doubtful value when an un-diagnosed condition exists, or is suspected to exist! The experienced collaboration of physician and pharmacist is not only indicated but required.

Specific conditions to be met in the installation and functioning of valves likewise demand scientific specialization . . . the working-together, understandably, of engineering and manufacturing experience to produce the valve to meet these conditions.

The successful experience of nearly a century of POWELL Engineering and manufacture of valves—and valves only—is at your service . . . in consultation, in prescription, in supply. This clinical know-how, gained in hundreds of thousands of "cases" is the professional asset we share with every POWELL Valve buyer.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati 22, Ohio

POWELL

Fig. 6061—Class 600-pound Cast Steel Swing Check Valve. Has flanged ends and bolted flanged cap, held securely by an ample number of bolts. The renewable disc is hung on a 5° angle and when wide open permits a full, straightway, unobstructed flow through valve body. Sizes 1¼" to 12".

The complete POWELL Line includes Globe, Angle, Gate, Check, Relief, Y. Non-Return and other types of valves in bronze, iron, steel, pure metals and special alloys to meet the demands of all branches of Industry for DEPENDABLE FLOW CONTROL EQUIPMENT.

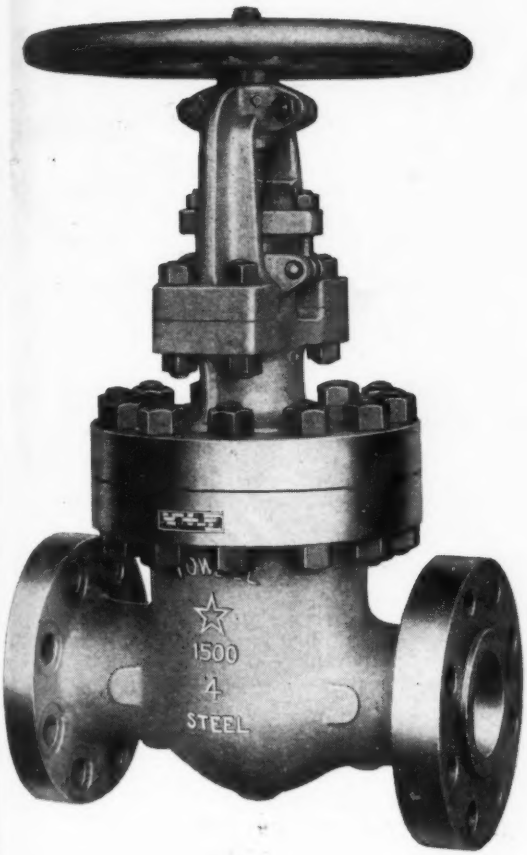


Fig. 1303—Class 1500-pound Cast Steel Gate Valve. Has flanged ends, outside screw rising stem, bolted-flanged yoke, taper wedge solid disc and renewable seats. Sizes up to 14".

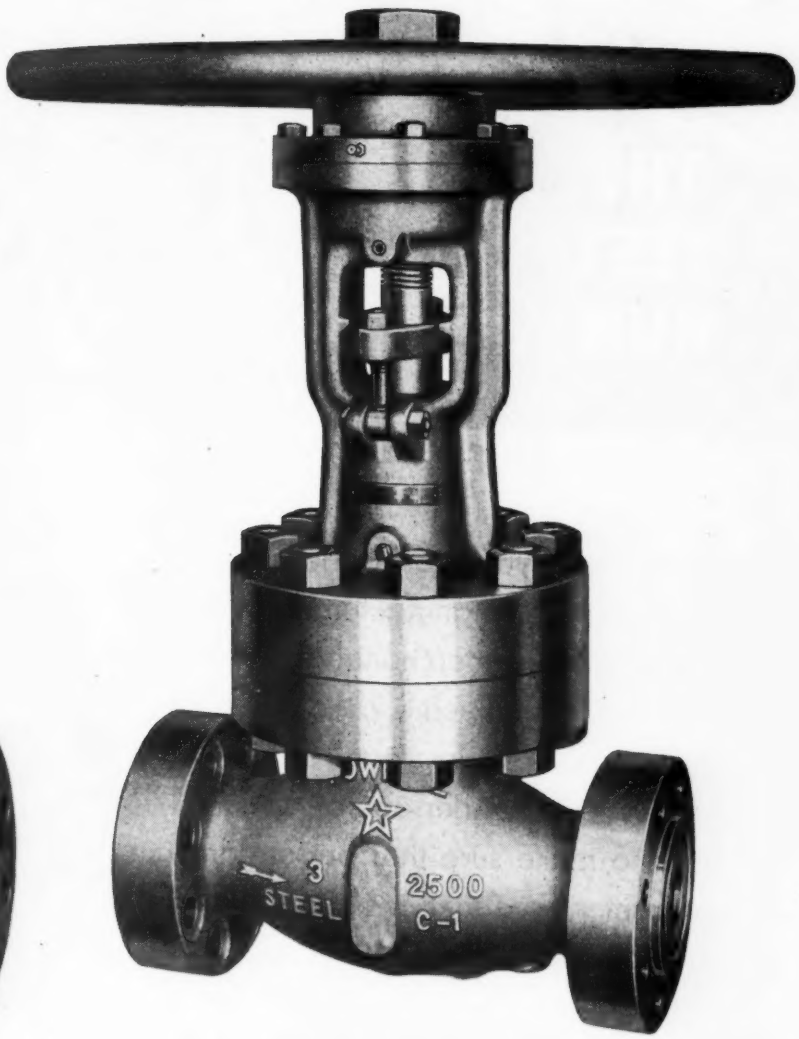
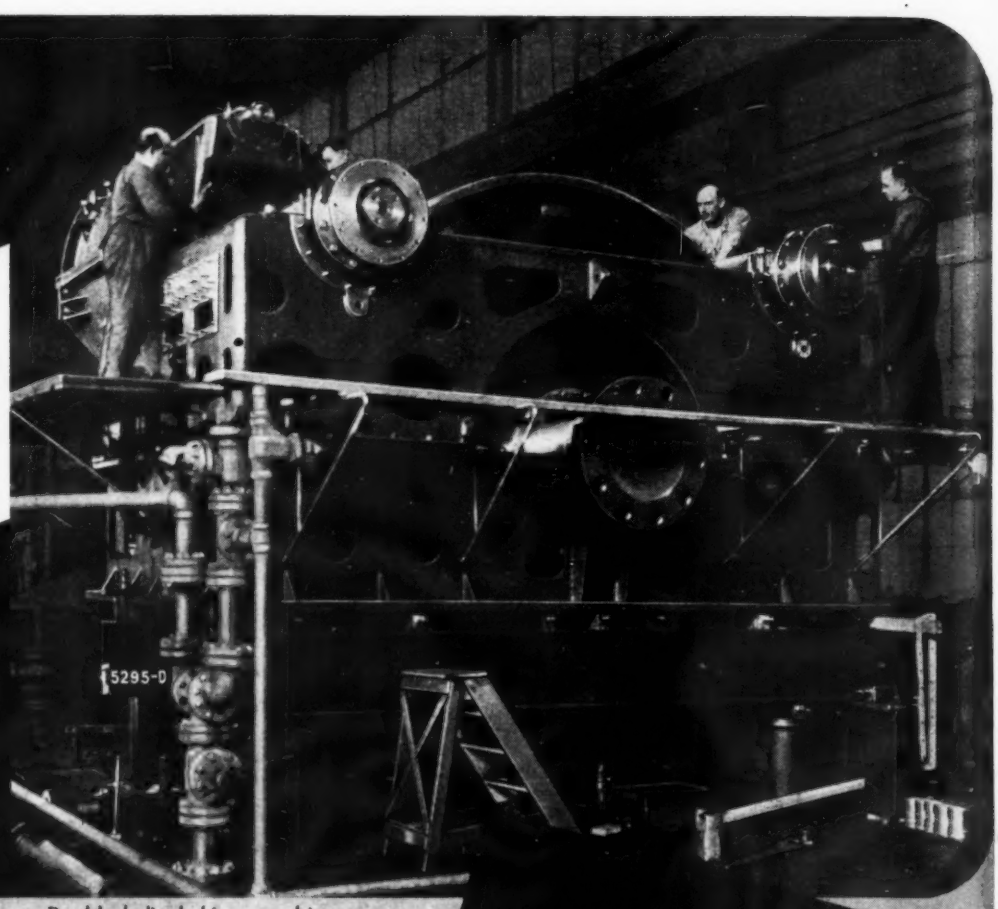


Fig. 25031—Class 2500-pound Cast Steel Globe Valve. Has flanged ends, outside screw rising stem and bolted flanged yoke. Sizes 1" to 6", inclusive.

VALVES

PARTS ARE GAGED *before and after* THE TEST RUN



Double helical ship propulsion gear on test floor at the De Laval Works

In the De Laval Works each part of a machine is manufactured to limit gages on an interchangeable basis and then, after assembly, the complete pump, compressor, steam turbine or gear is tested under operating conditions to make sure that performance guarantees are met and that the unit is mechanically perfect.

Following the test, the machine is taken down and the parts carefully scrutinized and gaged again, in order to detect any deviation from normal. This practice and policy insures that the purchaser will in every instance receive a correctly built and perfectly operating machine.

M-30

De Laval STEAM TURBINE CO.
TRENTON 2, N.J.

MANUFACTURERS OF TURBINES... STEAM, HYDRAULIC; PUMPS... CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS... WORM, HELICAL, and FLEXIBLE COUPLINGS

POWER

AUGUST, 1944 VOLUME 88, NUMBER 8

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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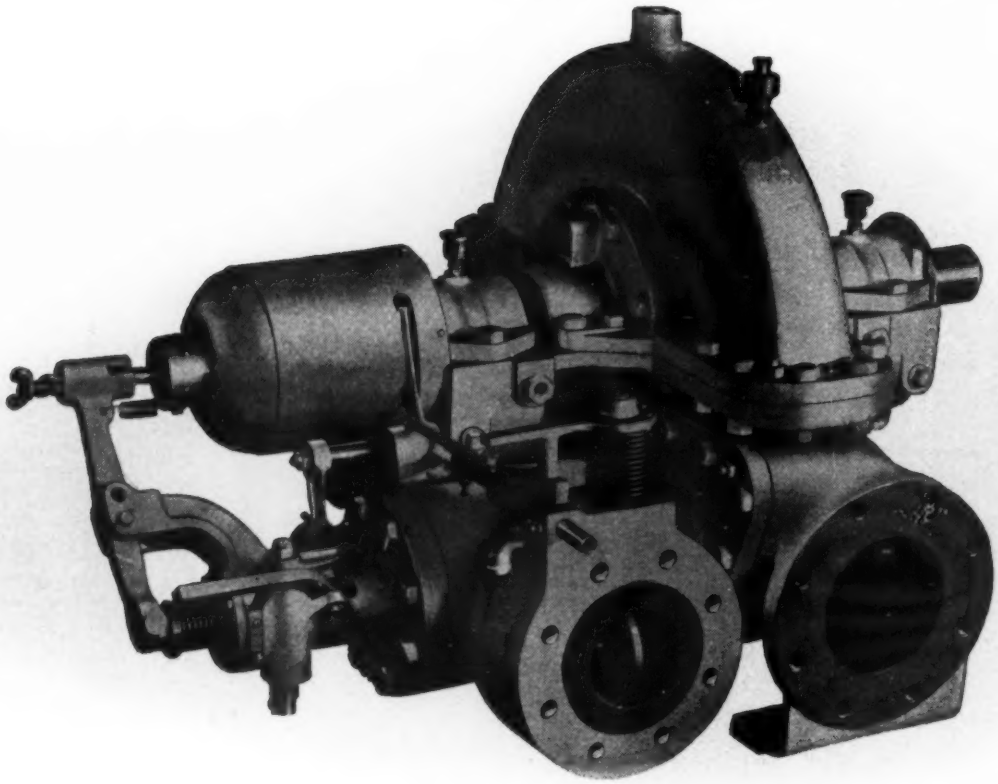
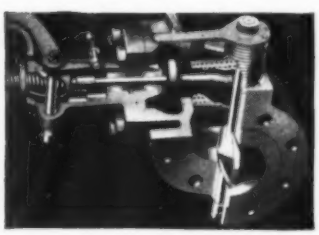
THE TURBINE WITH

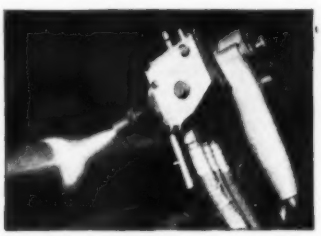


Steam turbines are expected to perform—and do, in all probability—for longer periods, with less attention than any other type of power drive. To meet these severe service demands, Westinghouse offers a complete line of Type C General Purpose Turbines with "built-in protection" against overspeed . . . steam leakage . . . explosion . . . unbalance.

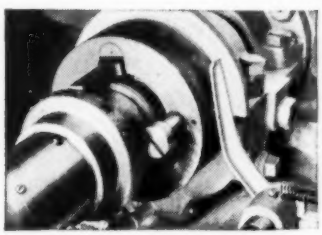
Built-in protection is typical of the plus features of Westinghouse General Purpose Turbines . . . features that result in extra reliability, extra safety, extra economy in operation. Competent engineering help in application problems and a nationwide maintenance service are as near as your telephone. Westinghouse Electric & Mfg. Co., Box 868, Pittsburgh 30, Pa.



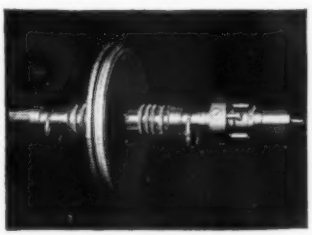
DUAL PROTECTION—During normal operation the turbine speed is controlled by the centrifugal-weight governor, or a regulator. If for any reason this control should fail, the overspeed trip device takes charge—simultaneously closing the butterfly valve and the governor valve when speed reaches 10 per cent above normal.



SHAFT PROTECTION—to prevent steam leakage and consequent oil contamination resulting from rust-cut carbon gland segments, shaft is sprayed with a generous thickness of high chrome-nickel steel at the two gland zones. Shaft is grooved, undercut and knurled to provide a permanent anchor for the sprayed metal. After spraying, entire shaft is finish-ground.



EXPLOSION PROTECTION—The only possible place a spark can occur in a turbine is on the overspeed trip lever. In applications where the turbine must operate in an explosive atmosphere, a sparkless overspeed trip lever with an insert of a special Westinghouse-developed plastic, Micarta, is used.

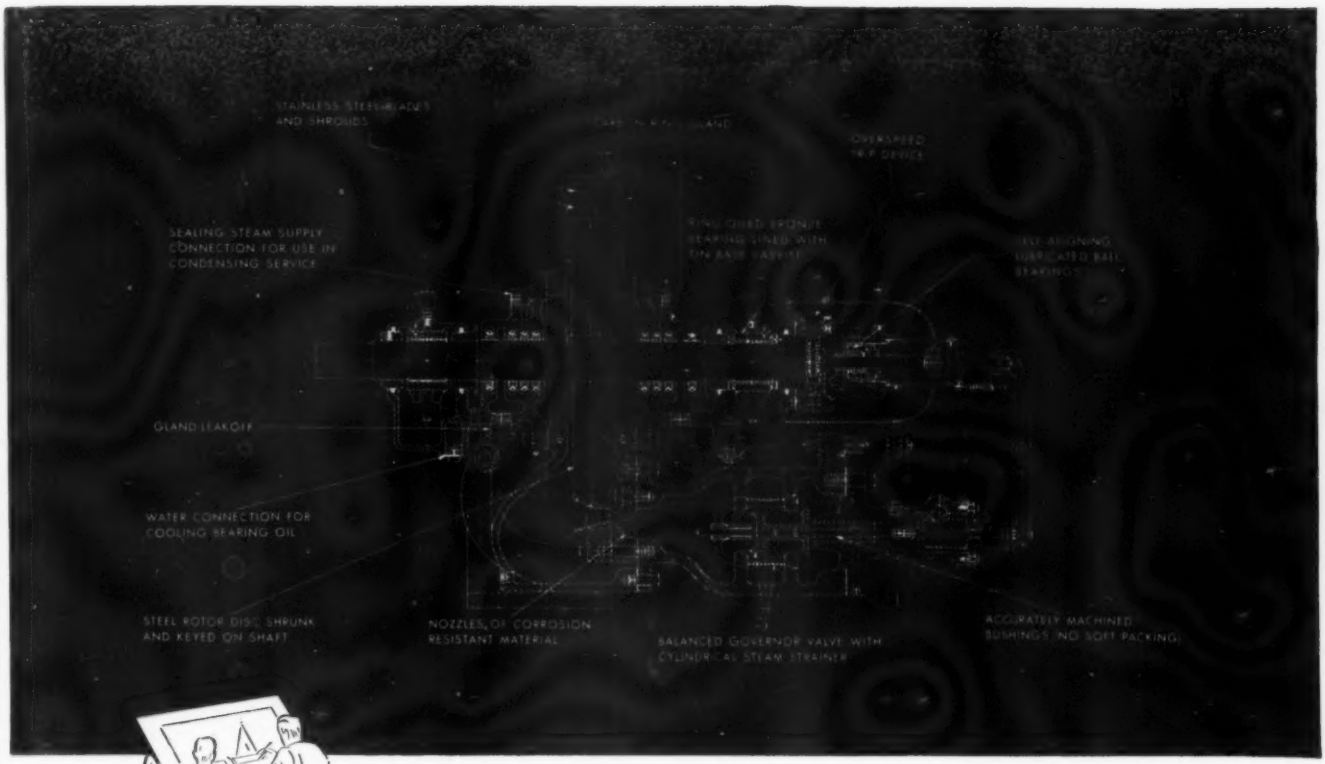


ROTOR PROTECTION—to sustain smooth operation, the rotor must preserve its original shape and dynamic balance in service. Placed in balance on the Westinghouse-developed Dynetric machine, the rotor is then coated with corrosion-resistant paint which insures maintenance of original shape and balance. Particularly important for stand-by or intermittent operation.

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Steam Headquarters

Built-in PROTECTION


STAINLESS STEEL BLADES AND SHROUDS
SEALING STEAM SUPPLY CONNECTION FOR USE IN CONDENSING SERVICE
GLAND LEAKOFF
WATER CONNECTION FOR COOLING BEARING OIL
STEEL ROTOR DISC, SHRUNK AND KEYED ON SHAFT
NOZZLES, OF CORROSION RESISTANT MATERIAL
BALANCED GOVERNOR VALVE WITH CYLINDRICAL STEAM STRAINER
ACCURATELY MACHINED BUSHINGS (NO SOFT PACKING)

DESIGN FEATURES

EASY TO INSPECT . . . by removing cover of horizontally split casing. All pipe connections are made to lower half of casing.

NO SOFT PACKING . . . for valve stems. Nickel-iron bushings have sufficient clearance for free movement of valve stems. Each stem has intermediate leak-off . . . minimizes leakage of steam into engine room. Governor valve and cage, butterfly valve and valve stems are highly resistant to corrosion and erosion.

CORROSION AND EROSION-RESISTANT NOZZLES . . . maintain proportions permanently. Passages are accurately drilled and reamed on a special machine that holds proportions precisely to design specifications—insures highest nozzle efficiency.

POSITIVE LUBRICATION . . . assured by ring-oiled bronze bearings lined with tin-base babbitt. Either bearing may be removed by unbolting bearing cover.

EFFICIENT CARBON GLANDS . . . held around the shaft by stainless steel garter springs, control steam leakage at points where the rotor shaft extends through the casing. A leak-off at each gland minimizes leakage past the outer ring.

EACH TURBINE FACTORY TESTED . . . by a running trial with steam for adjusting governor, setting overspeed trip, checking smoothness of operation, testing glands and steam joints. J-50447

Steam Headquarters

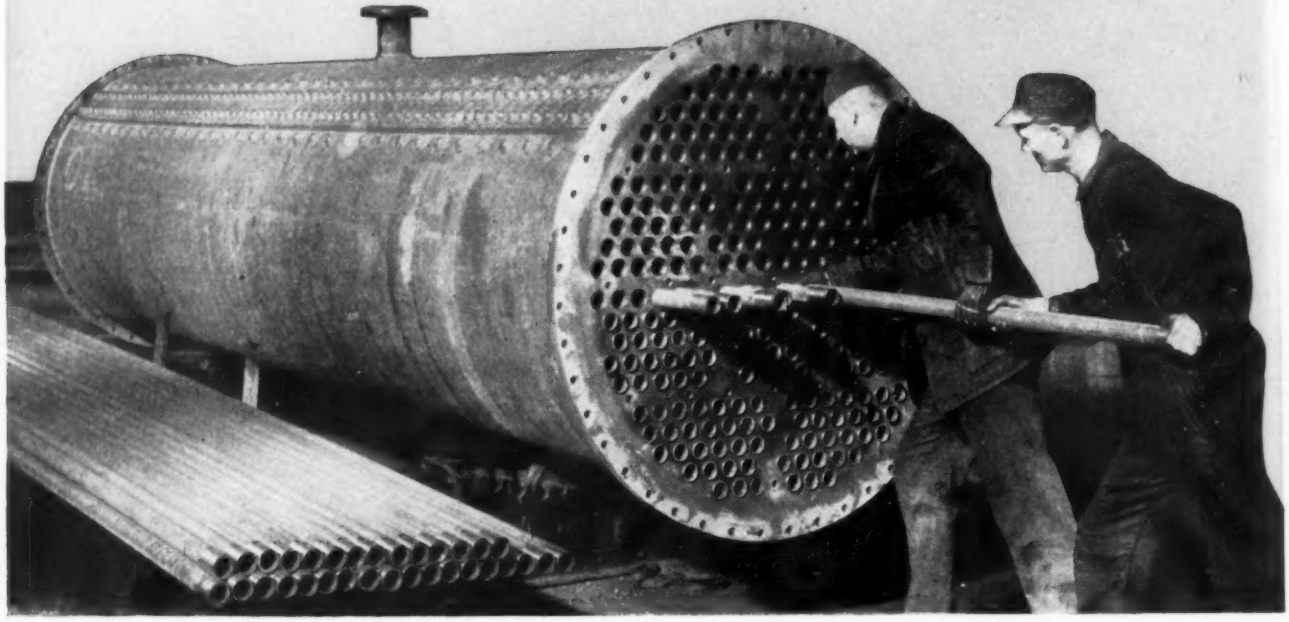
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Experience says—retube *THIS TIME* with

BYERS WROUGHT IRON

and *NEXT TIME* won't come so quickly



Corrosive conditions in heat exchangers are in general considered severe, and nothing much can be done to ease them. The only practical solution is the use of durable material—and that's where wrought iron is helping other engineers, and can undoubtedly help you.

One concern recently ordered a sizable quantity of 2-inch wrought iron OD tubes in 18-foot lengths to repair an ammonia condenser, while another ordered 10,000 feet of 3-inch standard black wrought iron pipe for installation in a brine pre-heater where temperatures of 200° were involved. The material previously used was giving only 6 to 8 months service, and the engineers believed wrought iron would last long enough to more than justify its slightly higher cost.

This latter installation is of additional interest, because of the fact that *pipe* was installed. Standard pipe is available with outside diameters approximating the various sizes of OD tubing. Any small differences in dimension can be easily compensated for by reaming the crown-sheet holes slightly larger, or by using a ferrule. The adoption of pipe eliminates stock problems, as material for minor repairs can be taken right from your supply, or immediately obtained from your jobber.

As an indication of the number and variety of service records available as a guide in specifying . . . one group alone covers 32 condensers, 16 built of wrought iron and 16 of low-first-cost materials. The life of the ordinary condensers ranged from 4 to 15 years, with an average of 8 years. The life of the wrought iron condensers ranged from 6 to 35 years, with an average of 19 years . . . 2⅜ times as great.

The unusual durability of wrought iron in heat exchanger service is easy to understand, when its unique character is considered. Fibers of silica slag, making up about 3% of the material by weight, are threaded through the body of high purity iron. These fibers give "defense in depth," halting and diffusing direct corrosive attack. They also firmly anchor the surface film, which shields the underlying metal.

You will find some helpful information on corrosion problems in heat exchangers and how other engineers have solved them, in our technical bulletin, "Wrought Iron in Refrigeration and Air Conditioning Systems." We will be glad to send you a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

THE NATIONAL DEBT—
and Your Postwar Job

Coming upon the heels of a ruinous ten-year depression, this war has once more made it clear to us that the strength of our country depends upon our ability and willingness to produce. Until the world conflict eclipsed the depression, we saw what failure to use our productive capacity can do—even to a country potentially as rich as ours.

The stark reality of war finally shocked us out of our economic lethargy. The necessity of supplying our Armed Forces with almost unlimited quantities of goods unleashed our inventive genius and revealed to us our real capacity to produce. It indicated what our standard of living might be if, in time of peace, we used our full productive capacity.

Today we are producing more than all the other nations combined, half again as much as in 1940. Today our production is insuring victory to our fighting men.

But what of the future?

Already our national debt has reached astronomical proportions, and it is going higher. The depression years' fear of insecurity that all but paralyzed our spirit of enterprise, our inventive genius, and our natural instinct for expansion, appears likely to return promptly if industrial activity again is curtailed for long because of unwise public policies.

This war is being fought to make men free. But our economy cannot be kept free through military conquest alone. There is another responsibility which we on the home front cannot avoid any more than we can build walls around our future. That is the problem created by our frightening public debt.

This is a two hundred billion dollar war. It affects the lives of every one of us. At the end of this war, the public debt of the United States will be at least ten times the twenty-five billion dollars that it was at the end of the first World War. It will be almost twice the present annual national income of the country. The interest charge alone will be about 4 per cent of the national income. If the burden were spread evenly, interest alone would take at least $80.00 of every worker's income per year, or approximately $1.60 out of each and every weekly pay check.

Some people fear that the heavy taxes required by the debt will keep the country poor by obstructing employment and limiting the output of goods.

Others believe that the size of the debt does not matter because we owe it to ourselves. They reason that if A is taxed $100 to pay $100 interest to B, A has $100 less to spend and B has $100 more, but both together have the same amount. They, therefore, hold that the demand for goods and the volume of employment remain unchanged.

Which view is correct?

Is our huge debt bound to be a crushing burden which limits employment and lowers the nation's standard of living, or will it simply redistribute income? May the public debt under certain conditions even be used to help increase employment and raise our living standards?

Most people, rich and poor alike, find it difficult to believe that the national debt "just doesn't matter". They know that the interest alone on this huge debt will be almost equal to the total amount of taxes ever raised before by the government for all purposes in any peacetime year. They find it difficult to follow the kind of reasoning that suggests increasing the already mammoth debt year by year in order to maintain full production and employment. They fail to see how this "debt raising" can go on indefinitely.

On the other hand, the records show that other nations have more than once successfully managed even greater debt burdens than will confront the United States after the present war. The interest on the British debt after the Napoleonic Wars was nearly 8 per cent of the national income, and after the first World War was over 7 per cent. But despite heavy taxes and some unfortunate mistakes in economic policy (such as restoring the prewar pound), per capita real income in Great Britain rose about 31 per cent between 1920 and 1929. In fact, it rose as rapidly as it did in the United States. The world depression was far less severe in Britain than it was in the United States; and, by 1936, when industrial production still was 6 per cent below 1929 in the United States, it was nearly 16 per cent above 1929 in Britain. Britain's heavy debt burden proved less of a handicap to her during the depression than our weak banking system did to us.

Whether the debt becomes a crushing burden or whether we use it to further our progress depends upon who holds the debt and how the money is raised to pay the interest.

Here are the important possibilities:

1. If the expenses of the government, including the interest on the debt, are met largely by heavy taxes upon business profits—i.e., by taxes upon job-giving—then they will reduce employment, output, and our standard of living, regardless of who holds the debt. Heavy taxes on profits prevent enterprise from expanding current operations or enlarging the capacity of its plants, unless the prospects for profit seem certain and the prospects for loss are slim. Hence the jobs that might be created to take advantage of long chances will not come into existence, and the country as a whole will be poorer.
2. If the expenses of the government are met largely by stiff surtaxes upon the incomes of persons who do a considerable amount of saving, and the debt is, in the main, owned by millions of small investors, then the net effect of the debt upon the volume of employment and output will be fairly neutral. The stiff surtaxes, while reducing the savings of the well-to-do, will cause them to avoid risky investments and to hold part of the savings of each year in the form of cash. This will limit the demand for goods and the volume of employment. But this effect will be partially offset if millions of small holders of the debt are led by their savings in government bonds to spend a larger part of their current income.
3. If the expenses of the government are met largely by sales taxes or other taxes on small incomes, and if the debt is held largely by the well-to-do or by business corporations, then the effect of the debt will be unfavorable to employment and production. The limitation to the spending power of the small-income group will reduce the volume of investment opportunities, and the transfer of income to the well-to-do will increase the volume of investment-seeking funds.
4. If the debt is widely distributed among millions of small holders, and the expenses of the government are met largely by taxes on individuals, if substantial exemptions from surtaxes are given for all income invested in new plant or equipment, and if there are liberal offsets for losses, then the debt will help increase employment and raise the standard of living. The millions of small holders will gain a sense of security from their accumulated savings and hence be encouraged to spend a larger portion of their current incomes. The stiff surtaxes will reduce the savings of the well-to-do; liberal exemptions for income put into new plant and equipment, and generous treatment of losses, will cause the well-to-do to invest their savings in job-giving enterprise rather than to hold them in idle cash.

But what is the situation today?

Today, non-banking corporations own nearly half of the Federal debt, commercial banks about one-fourth, and individuals less than one-fourth. Not more, and probably less, than one-tenth of the debt is held by persons earning less than $5,000—although these persons receive three-fourths of all income.

Today, about half of the revenues of the Federal government come largely from taxes which must be regarded as ***taxes upon the creation of new jobs.*** If these conditions continue, we may be sure that the debt will be a disastrous obstacle to a rising standard of living after the war.

What can be done to change this situation?

To begin with, vigorous steps should be taken to get much more of the debt into the hands of individuals, particularly of those in the small-income group. During the last three years, the incomes of individuals, after taxes, have exceeded the supply of consumer goods by $74.2 billion. In other words, individuals have been compelled, by the sheer scarcity of goods, to save over $74 billion. Of this amount, only $27.4 billion, or 37 cents out of every dollar, has gone into government bonds. Indeed, individuals have saved more in the form of cash and bank deposits than in the form of government bonds. The sale of war bonds to individuals was most disappointing in the recent drive. It was so disappointing, in fact, that I would favor a special drive ***for individuals only,*** to be scheduled before the next general drive. During 1944, when the supplies of civilian goods are severely restricted and when the fighting is at its climax, the Treasury will have its best opportunity to persuade individuals to buy more bonds. This opportunity should not be lost. An increase of at least twenty-five billion should be the goal for the next year. Every citizen should be made to understand that by buying war bonds now, he is not only helping to win the war; he is helping to make possible a more prosperous and stable America after the war.

The efforts to sell bonds to individuals should be vigorously continued throughout the shift from war production to civilian production. During this period, corporations which, up to now, have been the largest buyers of government bonds, will need all their depreciation allowances and undistributed profits to pay for new equipment, and to restore their own dealers' inventories. The government, however, will still have large bills to settle and will need to sell as many bonds as it can for some months after the end of hostilities. During this period, the demand for most types of goods is likely to exceed the immediate productive capacity of industry. Hence, the sale of bonds by the government will make for economic stability.

The huge expenses, including interest on the debt, which the government must meet after the war, require that the tax system be drastically reformed. Today, taxes fall most heavily upon those incomes which are the reward for increasing production and employment, because profits are taxed first as corporate profits, and taxed again as dividends to owners of the corporation. Surtaxes are so stiff and offsets for losses so meager that the well-to-do capitalists cannot afford to encourage and help promising young businessmen to start new enterprises.

A nation whose expenses are as large as those of the United States will be after the war must be sure that its tax system provides incentives, not penalties, for increasing production and employment.

Should the debt be repaid? Some people fear that any reduction of the debt would have a deflationary effect and cause unemployment. An opposite view was expressed by Mr. Morgenthau recently: "We have a big public debt that must be paid off, and the quicker we do that the better." Both of these views are extreme. Repayment of part of the debt during a period of depression would increase unemployment. Every period of high prosperity, however, would give the government an opportunity to pay off part of the debt without limiting employment. During these periods of prosperity, business corporations will sell government bonds in order to buy equipment; and many individuals will redeem war savings bonds in order to purchase houses, automobiles, and other goods. If the government budget runs a surplus during periods of high prosperity, and if this surplus is used to retire some of the bonds sold by corporations or redeemed by individuals, the country will be protected against a disorderly and speculative rise in prices. Thus, reduction of the debt can be made a device for stabilizing our economy.

There are two other reasons why reduction of the debt will be desirable.

In the first place, it will help prepare the country financially for a possible third World War. Determined as we are that this war shall be the last one, common sense tells us not to count on this. At any rate, we must be prepared for any eventuality.

In the second place, gradual reduction of the debt would stimulate employment by creating the expectation of lower taxes. It is not generally appreciated how much the willingness of individuals and business concerns to spend money is affected by the prospects of higher or lower taxes. One of the best ways to make individuals and enterprises spend more freely is to convince them that taxes will become a little lower, year by year.

Many people have difficulty in visualizing the day when there will be a substantial reduction in the burden of the national debt. And yet, if the country pursues wise economic policies, there is no reason why the debt burden should not be cut in half during the next generation.

The days of technological progress and economic expansion are not over. They are, in fact, only well begun. During the Twenties, the national income in dollars of constant purchasing power increased by well over 50 per cent. Between 1929 and 1939, it increased by less than 6 per cent. Perhaps the rate of the Twenties cannot be maintained indefinitely; but scientific research and development work in industry are laying the foundation for very large advances in national income. Suppose that the national income increases 33 per cent in the first decade after fighting stops (say, hopefully, 1945), 25 per cent in the next decade, and thereafter at the rate of 20 per cent a decade. In 1955, the national income (at present prices) would be about $173 billion; in 1965, about $216 billion; and in 1975, about $257 billion. By 1970, the burden of the debt would be reduced by nearly half, even if not a cent of it were repaid!

A huge public debt is a test of the character, the common sense, the foresight, and the equally important technical and engineering skill of a nation. *It requires that tens of millions of small income earners be willing to become substantial holders of the debt. It requires that the nation be willing to tax itself heavily, but in ways which increase the attractiveness of job-giving or self-employment relative to job-holding; it requires that the nation be willing to pursue policies of expansion and to put a rising income for the nation ahead of the pleas of self-seeking groups in labor, agriculture, and industry.*

A huge debt may so draw out the hidden powers of a people that it makes the nation wealthier rather than poorer, stronger rather than weaker.

Up to now, Americans have not met the test of a big public debt too well. Individuals have saved more in cash than in government bonds, and the country has shown little interest in avoiding the kind of taxes that reduce the demand for labor. These shortcomings, I am sure, stem largely from the fact that the American people never have had the problems of debt and taxation honestly and adequately explained to them.

I have confidence in the American people. I believe that Americans have the intelligence to understand this problem of the public debt, the character to face their responsibility regarding it, and the common sense to accept the challenge and make the most of it.

President, McGraw-Hill Publishing Company, Inc.

POWER

PHILIP W SWAIN, EDITOR • AUGUST 1944 • ESTABLISHED IN 1882

Future of the Heat Pump

LATEST ADVOCATE OF "HEAT PUMP" house heating to boost postwar power loads is Philip Sporn, vice-president and chief engineer of American Gas and Electric Service Corporation. He estimates (in his recent Edison Electric Institute paper) that converting all domestic heating from fuel to pumped heat would add 155 billion kwhr to yearly power sales.

Large-scale conversion is unlikely, but the possibilities of moderate application will properly attract utility executives, since each converted one per cent of American homes will add 1.5 billion kwhr per year—$15,000,000 at a one-cent power rate.

The power engineer, too, has a 3-way stake in the heat pump: (1) bigger central stations for him to design and operate, (2) heat pumps for him to install and operate in factories, buildings and institutions, (3) some day, perhaps, a unit in his own home.

The heat pump is an old idea—just an ordinary refrigerating plant operated for the sake of the heat discharged at the condenser end rather than the cold produced at the evaporator end. The plant draws heat from the outdoor air (or water supply) and delivers heat inside the building.

Only a fraction of the delivered heat comes from the motor's driving power. That's why one kilowatt hour (3413 Btu) can produce about 4.5x3413=15,360 Btu heating effect under typical conditions, the 4.5 being the "coefficient of performance."

Assuming this 4.5 heat-pump coefficient, and 65% efficiency for fuel-fired house-heating plants, Mr Sporn finds that one-cent electric power equals 12,000-Btu coal at $10.20 per ton, 550-Btu city gas at 23.4 cents per 1000 cu ft, and 1000-Btu natural gas at 42.4 cents per 1000 cu ft. These figures make electricity for the heat pump competitive with local fuels in many districts, so its commercial future will depend on the answers to other questions:

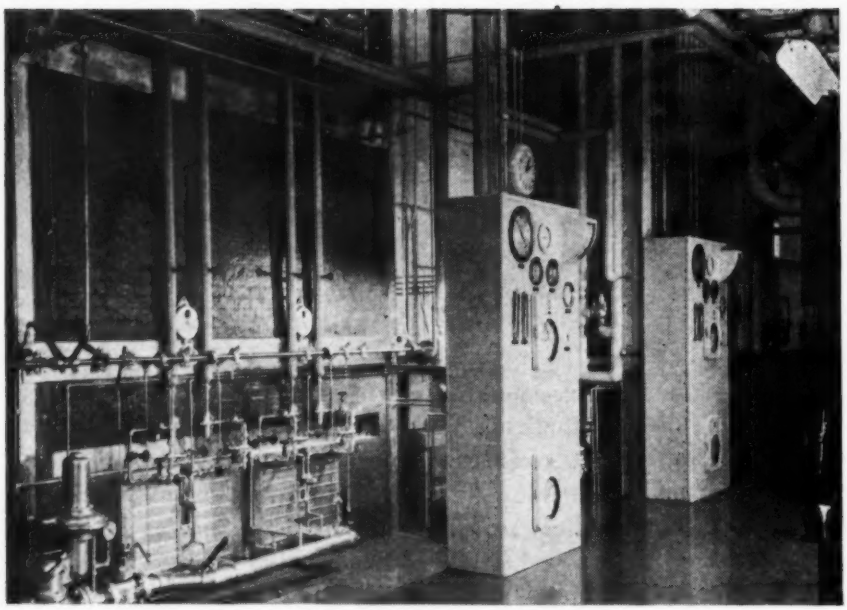
Can current for this use be sold at 1¢ or 1½¢ per kwhr? Presumably "yes" in those sections now selling power at comparable rates for certain heavy-duty domestic applications—perhaps in certain others, as well.

What about investment cost—still much too high for the average homeowner? Better design, mass selling and mass production could broaden the market. Early applications will be mainly in luxury homes and subtropical climates (California and Florida, for example) where the plant for summer cooling will be about the right size to handle winter heating without added investment.

What about installations in colder climates? Here the obstacles are many. Only a small part of the first cost can be charged to summer cooling. Colder weather increases heat demand and lowers coefficient of performance—a double penalty on first cost and power bills. Finally, existing designs of air-served evaporators plug with frost if the air falls to 32 F. Apparently nothing but an ample and low-cost supply of not-too-cold water (usually well water) can cure most of these ills.

The net conclusion for the power engineer is that the heat pump is no panacea, but has a substantial future where weather and water-supply conditions are favorable.

Outdoor Boilers Lick



Because the only structure available to house new wartime units was low and small, resourceful engineers placed the boilers outdoors with their fronts forming part of the existing building wall

Fig. 1—Boiler fronts that form part of the building wall carry fuel piping and combustion-control equipment. Separate boards serve individual boilers

Fig. 2—Boilerfeed pumps have two suction and discharge headers arranged for simultaneous operation of both. Pumps have excess-pressure governors

▶ WHEN GOODYEAR Aircraft's Arizona factory faced wartime demands that called for more than trebling its design capacity, the power plant could supply only steam, air and water-treating facilities proportioned to a prewar factory. In selecting equipment and designing additional facilities to meet the emergency, the engineering staff were guided by these four factors:

Speed: To provide power when other production facilities were ready, available materials and equipment had to be used. *Dependability:* Plant must operate continuously—periodic shutdown of any service could not be tolerated. *Use of existing building:* A single-story 50x100-ft steel sawtooth building, with only 16-ft clearance under the roof truss lower chords, occupied ground desirable for the new power plant. Further, the shallow sewer system precluded use of deep pits or basements. *Economy:* For low operating costs and a usable postwar installation, the plant had to be efficient.

Principal prewar equipment was:

3 boilers.....Eclipse Fuel Engrg Co
100-psi 490-sq-ft automatic-gas-fired vertical firetube, served by individual forced-draft blowers and off-on feedwater pumps
2 air compressors.....Chicago Pneumatic Tool Co
800-cfm 2-stage synchronous-motor-driven vee-type
1 softener.....Culligan
Duplex zeolite, rated 35 gpm on each tank
1 water still, 100 gph.....Stokes

Factory water system is built around three deep wells that furnish water having from 15 to 30 grains per gal hardness. Softening is adequate for many jobs, but electrolytic process requires large quantities of distilled water. A large still produces the necessary quantity, which is stored in a 10,000-gal tank internally treated to prevent contamination. Induction motors drive two well pumps while the third uses dual drive—vertical induction motor with connection through clutch and shaft to a 6-cyl multi-fuel engine. Control that maintains water level in an elevated tank provides for manual start-and-stop, overload protection and time-delay motor starting.

Redesign Problems

Complying with War Production Board rulings, we secured two 3520-sq ft sectional-header cross-drum boilers. To meet local requirements boilers and settings were completely redesigned, but the original steel was utilized by welding on the required extensions, and by field fabrication. Units were separated into single settings, and rearranged for induced-draft operation and for either oil or natural-gas firing.

Before erection, we sandblasted the pressure parts and replaced questionable items, including several tubes externally corroded, adjacent to the headers. Layout of new settings shifted the bridgewall almost to the rear-support wall, but retained the original baffle arrangement by a T-tile arch extending forward to the front baffle's lower edge. Absence of economizer and air preheater surface limited the effective heat input to values that could be safely handled by the large furnace volume produced by the deep bridge wall and high setting. Aircooling floor and front-wall support protected these critical points when operating at high ratings.

Because of low headroom and need of floor space for other purposes the boilers stand outdoors. Removing a section of one wall, we faced the boilers inside, thus putting the firing aisle within the building. Induced-draft fans, mounted on elevated steelwork, are driven by induction motors. Stub stacks carry flue gas high enough to clear all buildings, yet are sufficiently low not to be a hazard to an adjacent airport.

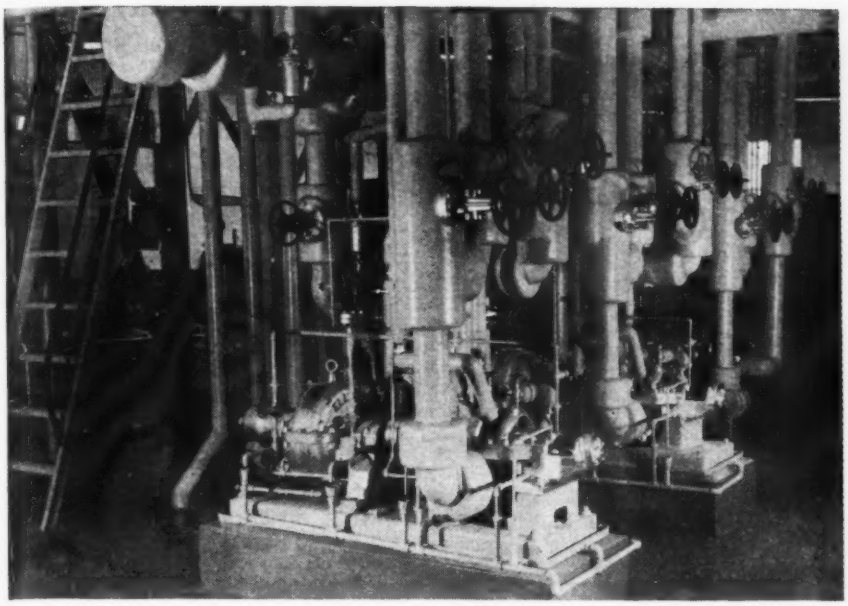
The switch from coal to oil and gas firing required new burner equipment, including an automatic combustion-control system. Multi-jet natural-draft burners were incorporated in two banks in each boiler front. Provision is made for quick coupling of a steam atomizing oil jet. CO_2 is maintained at 10.5 to 11.0% on gas, and 12.5 to 13.0% on oil throughout the normal range of automatic operation.

Other modernizations included: (1) feedwater regulators (2) increased-capacity pop valves (3) new gagecocks and alarms on water columns (4) peephole doors at numerous furnace points (5) one set of blow-off valves replaced with modern ones.

Changes in boiler and combustion

Floor-Space Shortage

By F M SWENGEL
Goodyear Aircraft Corp



equipment permit operation up to 22,000 lb per hr per boiler although normal requirements are met with a boiler output of 18,000 lb per hr.

An extensive condensate return system was embodied in the factory and office areas, but we still require about 15% makeup. Zeolite-treated water is deaerated and preheated before blending with the condensate, high boiler concentrations being controlled by continuous blowdown. Internal boiler treatment adds sodium sulphate and trisodium phosphate, accompanied by carefully scheduled low-load manual blowdown. Complete laboratory equipment facilitates boiler-water analysis. We maintain drum concentrations below 2000 ppm, pH 10.5 to 11.5 and sulphate-carbonate ratio at recommended levels.

Condensate returns collect in a 3000-gal closed tank, into which the zeolite-treated makeup feeds under float control. From here, or from the distilled-water storage tank (or both) a battery of pumps transfer water to the deaerating feedwater heater. Heater sits on an elevated steel structure to produce the necessary head for boiler-feed pumps. An open bay under a sawtooth truss saved building alterations. The vent condenser had to be remounted for clearance, but involved no major changes. The deaerating heater normally operates at pressures up to 8 psi, at which pressure a safety valve opens. Further pressure rise is prevented by a loop seal proportioned to blow at 9 psi. Below the heater a horizontal water-storage tank holds a 21-min supply at rated load.

Dual suction headers supply the three boiler-feed pumps. Each pump has an excess-pressure governor. A direct-acting duplex pump takes care of light loads, higher ratings being supplied by two 2-stage 3550-rpm double-suction 80-gpm-at-564-ft centrifugal pumps, one motor- and the other steam-turbine-driven. Exhaust steam from duplex pump and steam turbine goes to the deaerator, with provision for atmospheric exhaust.

Boiler-feed instruments mount on a gageboard adjacent to the firing aisle that also carries deaerator-pressure and deaerator feed-pump pressure gages. Each boiler has its panel mounting a 4-pen boiler meter, gas-flow meter, steam, gas and oil gages, and atomizing steam-pressure, oil-temperature, and mercury-column gages for burner gas pressure. Induced-draft fans are controlled from the boiler panels and fuel oil is controlled by adjacent valves.

Natural gas, led directly from the utility lines to pressure regulators, is available at economical rates.

Fuel oil comes by rail and is unloaded by two duplex steam pumps, which also serve as transfer pumps. Main storage is in a 2250-bbl vertical tank, while a 250-bbl unit near the boilers acts as service tank. Oil is metered during unloading and transferring. Motor-driven oil-burner-pressure pumps in a fireproof inclosure take suction from the service tank and deliver through thermostatically controlled fuel-oil heaters into a dual system. Excess oil over burner requirements bypasses to the service tank, thus eliminating the need for heating this tank except when starting up. All tanks contain low-pressure steam coils, and unloading pumps are arranged to exhaust steam to railroad-car coils or to tank coils as required.

Three new compressors are identical with the two earlier units. Motors are 125 hp, unity pf, 600 rpm arranged for separate excitation and equipped for reduced-voltage starting. Excitation comes from five motor-generator sets. Starting equipment consists of two panels with time delay mechanisms which progressively supply reduced voltage, full voltage, and exciting current, and three panels that perform the same functions with a polarizing relay instead of time delay, to time field-current application. Starter panels are energized from the exciter-motor circuit, thus effectively preventing operation of main drive motors without field.

Compressor plant uses underfloor piping exclusively with provision for a sixth unit. Cooling water, drain and air-discharge lines are sectionalized for servicing. Two 48x144-in. receivers, fed separately or in parallel, form opposite ends of the main factory air-line loop. Intake header also forms a loop, with risers for each compressor. Incoming air goes through two air-filter banks, one at each end of loop.

Cooling-Water Hookup

An induced-draft cooling tower containing eleven sections of spray-cooled copper-tube heat exchangers mounts above a concrete basin. A battery of three 140-gpm pumps is arranged thus: One pump normally circulates tower water; another takes suction from a hotwell and delivers through the cooling-tower heat exchangers and then to the compressors, diesel engine and still condenser; the third serves as standby or additional capacity for either circuit, with valving arranged to permit single-circuit-operation when desired, without loss of sight discharge on water-cooled equipment.

Bypasses on the tower, heat exchanger and pump give adequate temperature control. A hotwell collects returns from all water-cooled equipment, and has a float-controlled soft-water makeup line. Emergency feed supplies either domestic

or softened water directly to the cooling system, discharging to sewer through hotwell overflow pipe. Pressure and temperature gages, high- and low-water alarm, and low-pressure alarm switches are located at the cooling-water pumps. Cooling tower makeup is float controlled, and may be either softened or raw water. A drain sump containing two float-controlled motor-driven pumps serves the entire system of underfloor trenches, cooling-tower basin drain, and other below-floor-level points.

A central switchboard incorporates the incoming 440-v feeder and circuit breaker, motor and lighting circuits, and all motor starters except the compressor motors. The latter mount inside inclosure panels which form a continuation of the switchboard. Entire board is of steel-cased dead-front construction.

A 200-hp 6-cyl totally inclosed diesel engine direct connected to a 156-kva alternator and exciter serves as emergency power source. Engine-generator unit can be paralleled with the utility supply over the powerhouse bus. A low-voltage release on the main incoming circuit breaker facilitates independent operation during outside power failure.

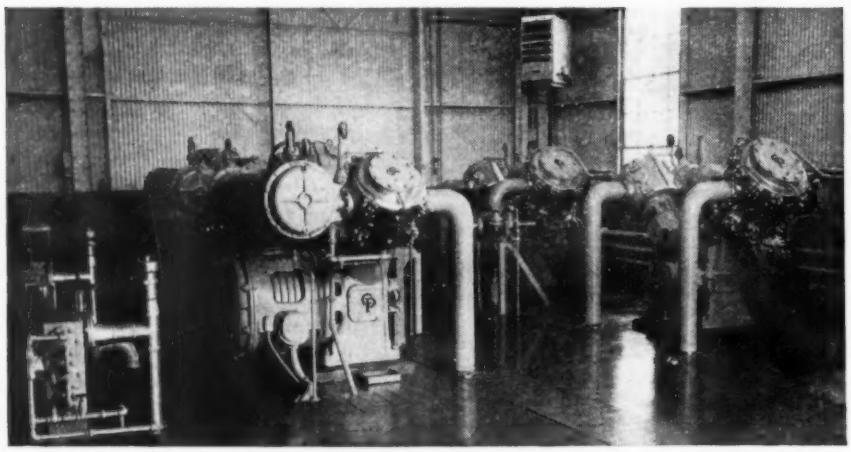


Fig. 3—Four of the five induction-motor driven air compressors. Wood planks instead of metal plates cover floor trenches that contain air and water piping

A 2-stage motor-driven air compressor, discharging into two 20x60-in. welded air receivers, supplies starting air for the diesel. A single-cylinder gasoline-engine-driven compressor serves as standby.

Water Treatment

The Culligan duplex zeolite softener was reinstalled to serve the powerhouse, while a new Elgin 114-gpm unit serves the factory. Provision is made for parallel operation. Both softeners use Hersey electric alarm meters and have single valve arrangement for recharging. Brine tanks are charged through chutes from a room adjacent to salt-storage area.

Distilled water is supplied by the original Stokes 100-gph still, which is now arranged for soft-water feed to the distillation chamber, and condenser cooling from the main cooling-tower circuit. A float-controlled pump takes suction from a 40-gal distillate hotwell and boosts the water to the 10,000-gal storage tank. A standard-pressure distribution system uses a Myers pressure-controlled bulldozer pump feeding two 40-gal pressure tanks. A Gould centrifugal pump provides extra capacity.

Goodyear engineers, who designed the plant, supervised construction. General construction contractor was the P W Womack Construction Co, while C C Moore & Co, handled boiler erection.

PRINCIPAL POWER AND COMPRESSED-AIR EQUIPMENT

Goodyear Aircraft Corp, Arizona Division

STEAM-GENERATING EQUIPMENT:

Boilers, 2.....Babcock & Wilcox Co
3520-sq-ft sectional header, cross drum, 160 psi
Furnace refractories.....Harbison-Walker Refractories Co
Induced-draft fans.....B F Sturtevant Co
Water columns.....Reliance Gauge Column Co
Continuous blowdown.....Cochrane Corp
Blowdown valves.....Yarnall-Waring Co
Feedwater regulators.....Northern Equipment Co
Fuel burners, combustion control; oil heaters.....Leahy Mfg Co
Fuel-oil pressure pumps.....Geo D Roper Corp
Fuel-oil unloading pumps.....Warren Steam Pump Co
Fuel-oil meters.....Smith Meters, Inc
Fuel-oil strainers.....Elliott Co
Gas regulators.....Reliance Regulator Co
Thermal insulation.....Johns-Manville, Inc
Boiler meters; gas-flow meters.....Bailey Meter Co

FEEDWATER SYSTEM:

Boiler-feed pumps, 2; motor drive.....Allis-Chalmers Mfg Co
3550 rpm, 80 gpm at 564 ft head
Turbine drive.....Elliott Co
Duplex boiler-feed pump.....Warren Steam Pump Co
Deaerating feedwater heater.....Swartwout Co
Deaerator feed pumps.....Ingersoll-Rand Co
Water still.....F J Stokes Co
Deepwell pumps, 3.....Layne & Bowler, Inc
Valves and piping.....Crane Co

COMPRESSED-AIR EQUIPMENT:

Air compressors, 5; aftercoolers.....Chicago Pneumatic Tool Co
2-stage, 600-rpm, 14 1/2x9x7
Air flowmeters.....Bailey Meter Co
Intake filters.....American Air Filter Co
Starting air compressor.....Worthington Pump & Machinery Corp
Standby compressor.....Atlas-Imperial Diesel Engine Co

GENERATING EQUIPMENT:

Diesel engine.....Atlas-Imperial Diesel Engine Co
Pyrometer.....Illinois Testing Laboratories, Inc
Intake filters.....Vortex Mfg Co
Generator and exciter (156 kva).....Electric Machinery Mfg Co
Switchboard.....Square D Co
Circuit breakers.....I-T-E Circuit Breaker Co
Voltage regulator.....Simplex Corp
Annunciator panel.....Edwards & Co, Inc

MISCELLANEOUS:

Synchronous motor starters.....Electric Machinery Mfg Co; Clark Controller Co
Sump pumps.....Ingersoll-Rand Co
Cooling tower; heat exchangers.....The Marley Co
Cooling-water pumps.....Ingersoll-Rand Co
Gasoline-engine drives.....Waukesha Motor Co
Dual-drive reduction gear.....Johnson Gear Works
Temperature indicators.....Weston Electrical Instrument Corp
Fire pumps.....Fairbanks, Morse & Co
Alarm-system switches.....Mercoid Corp; Allen-Bradley Co; General Controls Co
Driving motors.....Westinghouse Elec & Mfg Co; General Electric Co; Electric Machinery Mfg Co; Fairbanks, Morse & Co; U. S. Electrical Motors; Delco-Remy Div
Gages.....Ashton Valve Co; Ashcroft Gauge Div; Jas P Marsh Corp
Steel fabrication.....Allison Steel Co
Fuels and lubricants.....Shell Oil Co
Laboratory equipment.....Fisher Scientific Co
Paints.....Matthews Paint Co; Tnemec Products Permite Co

For Good Performance Give Your Centrifugal-Pump Packing A Break

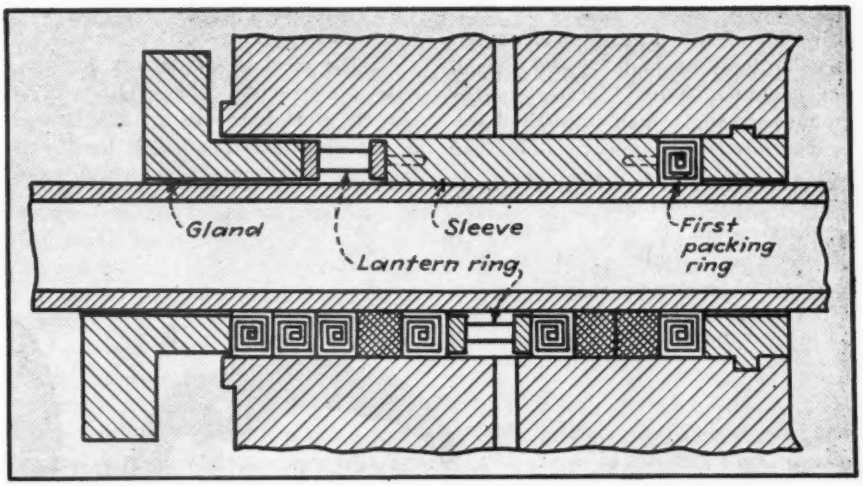


Fig. 1—When you install packing to hold against high pressure, tightly press in each ring with a split sleeve machined to fit the stuffing box

What practices help difficult packing applications on centrifugal pumps do a better job? Here are pointers from Hugh Platt, service engineer, Byron Jackson Company, together with the causes of some failures and their correction

▶ NO MATTER HOW high packing quality may be, its performance is no better than the care and intelligence used when you installed it. Moreover, unless operating conditions are correct, the best grade for a given application has short life and is otherwise unsatisfactory. This is particularly true of packing for high-speed centrifugal pumps handling volatile, high-pressure or high-temperature liquids.

Except for simple low-pressure water service where coil- or spool-form packing cut to the correct length is satisfactory, use packing accurately die formed to fit stuffing box and pump shaft. When packing must hold against high pressure, particularly with light petroleum or other volatile liquids, tightly press each ring in place as you install it. Do this with a split sleeve machined to fit the stuffing box with 0.005-in. clearance and approximately three packing rings shorter than the box depth, depending on gland and lantern-ring length, Fig. 1. If necessary make the sleeve in two lengths, using only one length to help compress the outer rings. Drill and tap a hole in both ends of each section so that you can easily remove it by a bolt or hook. In the stuffing box, Fig. 1, the first ring of the top half is being tightened in place, while the bottom half is shown completely packed.

Put the inside ring in the stuffing box and with the sleeve, lantern ring and gland force the packing against the bottom of the box until it is good and tight on the shaft, which is then rotated a few times by hand. Put each ring in place with successively less pressure. Plastic packing should be compressed less than the denser grades or metallic packing.

When the stuffing box is full, snug up the gland quite tight and back off until the nuts are finger tight against the gland. If leakage is excessive after the pump starts, slowly and evenly tighten the gland until leakage is reduced to desired amount. With some plastic packings, pumps with no leakage may run for days or even weeks and not overheat. But such operation is not recommended because the rings next to the gland are likely to score the shaft.

If Packing Heats

If the packing starts to heat on the initial run, don't let it burn as you have to replace burned packing. When packing cannot be kept cool with water in the jacket or around the outside of the box, stop the pump, thoroughly cool packing and stuffing box and restart. Once they start to heat, most packings soften and expand; with continued pump operation, they get worse. If the pump is shut down and the packing cooled, it contracts to its original density. When the pump is started again, the packing may permit sufficient leakage to keep it cool and operate satisfactorily. To break in the packing of a turbine-driven pump, turn unit over slowly and gradually bring it up to speed. Because this cannot be done with motor drive, next best thing is to start and stop unit several times until packing is free and does not overheat.

Two common causes of packing trouble are: (1) *vibration*, which may be caused by dynamic unbalance, defective bearings, bent shaft or an eccentric shaft sleeve in the packing; (2) *shaft deflection*, which results from poor hydraulic or mechanical design, particularly in a single-volute pump operated above or below rated capacity.

Pumps equipped with sleeve bearings may leak excessively through their packing when they are stopped because of clearance in the bearings. When the pump is running the lubricating-oil film tends to center the shaft in the bearings, but when it stops, the shaft drops down the thickness of the oil film, plus shaft sag. These actions decrease the packing pressure on the top side of the shaft and permit more leakage. To stop it, do not tighten the packing gland or, when the pump starts, the packing will be too tight on the shaft and overheat. For excessive leakage, close suction and discharge valves, if there is no check valve in the line. Or if practicable install a mechanical seal.

Damaged or improper shaft sleeves frequently cause packing trouble. Hard-

ened or hard-surfaced sleeves, which are widely used, have their limitations. Hardness is not a criterion of shaft-sleeve life. Nitrided nitralloy has a surface hardness as high as 800 Brinell but should not be used in water or other liquids corrosive to iron. Also, the hardened surface is only approximately 0.010 to 0.015 in. thick, so that when operating under abrasive conditions this skin may be quickly worn off.

Low-carbon (0.1%) 11.5-to-13%-chrome iron, commonly called steel, resists corrosion fairly well, can be hardened to 325 Brinell and is tough. It is not hard enough, however, to operate in aluminum- copper- or phosphor-bronze-foil packings. High-carbon (0.3%) 11.5-to-13%-chrome steel hardens to 500 Brinell but is brittle and not so tough and wear resistant as the softer low-carbon 11.5-to-13%-chrome steel.

Stellite or other hard surfacings are excellent if properly applied and heat treated. They have Brinell hardness of 500 to 550, depending on the material in the sleeve body, and are hard enough for aluminum- copper- or phosphor-bronze-foil packings.

Carbon steel is satisfactory for non-corrosive service, but 11.5-to-13%-chrome steel hardened to 325 Brinell or 18-and-8 stainless steel, hard surfaced, are commonly used for water and other corrosive liquids. Their surfaces take a high polish and resist corrosion well. Monel S is highly resistant to corrosion, does not require heat treating, has a hardness of 325 Brinell as cast, is very tough and wear resistant, but it is hard to machine and expensive. These materials, as well as others, have not all the ideal qualities for centrifugal-pump-shaft sleeves, but are used extensively and are the best available.

Surface speed of the impeller shaft is another important factor in packing applications. Do not confuse shaft revolutions with its surface speed. It is the latter that affects packing. A 1750-rpm pump with a 4-in. shaft, has an effect on packing about equivalent to a pump with a 1⅛-in. shaft operating at 6600 rpm, other conditions being equal. For this reason, when packing conditions are severe a vertical-shaft pump that permits a smaller diameter shaft may be more desirable than a horizontal-shaft design.

Mechanical seals have advantages for high pressures, light fractions and liquefied gas where leakage is objectionable. However, I feel that the right packing correctly installed, with a sealing-oil system, also required with a mechanical seal, does as good a job and is easier and cheaper to renew if dam-

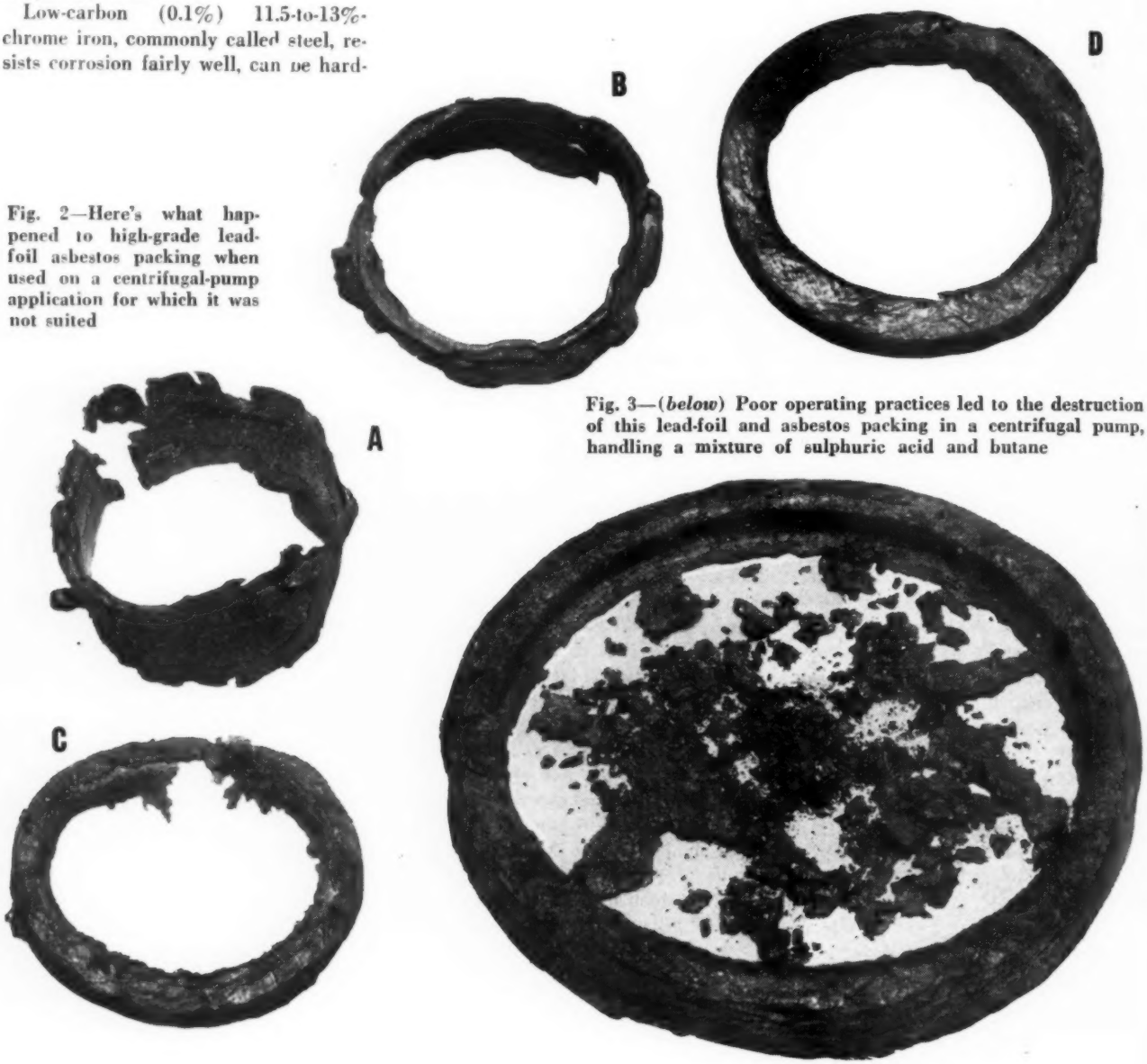


Fig. 2—Here's what happened to high-grade lead-foil asbestos packing when used on a centrifugal-pump application for which it was not suited

Fig. 3—(*below*) Poor operating practices led to the destruction of this lead-foil and asbestos packing in a centrifugal pump, handling a mixture of sulphuric acid and butane

aged by wear, corrosion or other causes.

Photos, Fig. 2 to 4, indicate what can happen when high-grade centrifugal-pump packing is improperly applied or the pump poorly operated. In Fig. 2, exhibits are from a stuffing box on a 2.75-in. stellited shaft sleeve operating at 3600 rpm. The packing, die formed, consisting of soft-lead foil outside a large asbestos core was used to hold against 100-psi propane. Packing included four rings inside the lantern ring and four outside, with lantern ring dead ended and sealed with kerosene at 110 psi.

This packing was sensitive to gland pressure, one-twelfth turn on the gland nuts meaning the difference between operating and not. After a few days' service the packing failed suddenly. Lead next the shaft on the inner packing rings extruded into the lantern, forming ring *B*, and shut off the sealing oil. From the outer rings lead extruded into the gland to form sleeve *A*. *C* is the first packing ring inside the gland and *D* the first ring inside the lantern. We corrected this trouble by replacing soft-lead-foil with babbitt-foil packing. On two other pumps taking suction at 250 psi with lead-foil packing we cured the trouble with one ring of bronze foil inside the gland and lantern and babbitt-foil packing for the other rings.

Fig. 3 shows how poor operation ruins good packing. This packing came from a pump that handles a mixture of sulphuric acid and butane, using unrefined kerosene for sealing fluid on the lantern ring. A butane connection in the stuffing-box bottom carried a higher pressure than inside the pump to keep acid away from the packing, which was blue asbestos inside and lead foil outside the lantern ring. Stopping up an orifice in the butane purge line let sulphuric acid work out to the lead-foil packing outside the lantern ring. Also the unrefined kerosene sealing fluid contained caustic.

The photo shows what the caustic and acid did to the lead-foil packing. Rings became hard and brittle, and the inside quarter in the form of a semi-circular groove disintegrated into small pieces like those inside the ring. Cleaning the butane purge connection, using refined kerosene for sealing fluids, and putting in new packing like the original corrected the trouble.

Out-of-Balance Impeller

Out-of-balance of the impeller caused the failure in Fig. 4. Packing included all plastic inside the lantern ring and all die-formed babbitt-foil packing with a small plastic core, between gland and lantern. When started, the impeller gave evidence of being out of balance and the babbitt packing began to come through the gland in fine flakes. In less than 15 min the pump had to be shut down because of sealing-oil leakage through the gland. When the packing was removed, about ⅓ of packing ring *A* next to the gland had wiped out. Damage to the other packing rings decreased back to the lantern, the last ring being shown at *B*.

On opening the pump, a piece of 3-in. angle iron was found lodged in the impeller. With the vibration cause removed and the stuffing box repacked with the original grade of packing the pump operated satisfactorily. This is an excellent example of how vibration or shaft whip may ruin a good packing in a few minutes.

That the shaft sleeves on none of these pumps was seriously damaged speaks well for their hard surfacing.

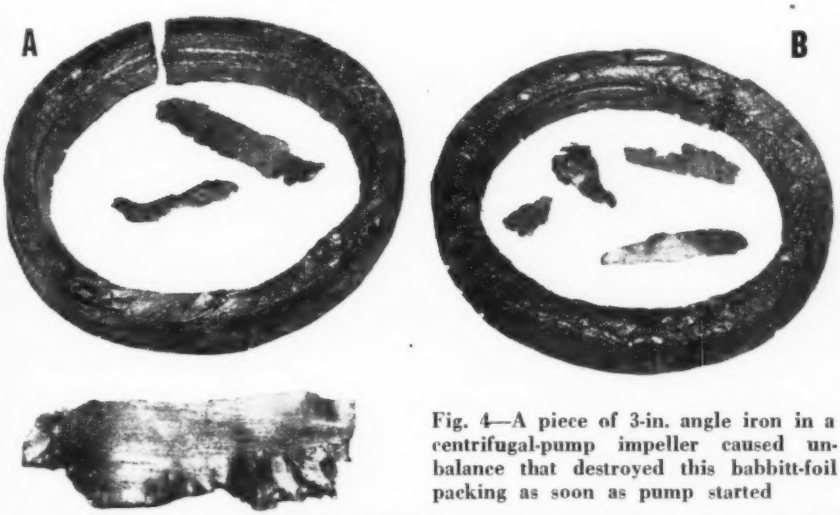


Fig. 4—A piece of 3-in. angle iron in a centrifugal-pump impeller caused unbalance that destroyed this babbitt-foil packing as soon as pump started

The Strange Case of the Lazy Water Wheel

BY N L REA
General Electric Co.

▶ ONE COLD WINTER'S MORNING a telephone call came in from the owner of a large grist mill. He was in serious trouble and wanted an Expert Engineer immediately, if not sooner.

He owned a small 75-kva waterpower plant a short distance from town that supplied power to an induction motor in his grist mill. This motor was belted to the lineshaft along with a corliss steam engine. Everything had been operating all right until someone accidentally opened the circuit to the induction motor. Then generator and water wheel stopped dead and could not be started.

He didn't expect I could tell him by phone what was wrong, so he wanted an Expert on the first train and would be waiting at the railroad station.

Naturally, I awaited the Expert's report with interest. Here's what happened:

Along about midnight the temperature had dropped sharply and there had been a brisk wind to ruffle the surface of the mill pond. It was an ideal combination for "frazil," or anchor ice formation. This had gathered on the trash racks at the intake, gradually shut off the water, and then frozen solid.

When the generator dropped in speed from lack of water, the induction motor at the mill was above synchronous speed and drove the generator and water wheel as an induction generator, obtaining its excitation from the generator and its power from the steam engine through the lineshafting in the grist mill.

The Irish engineer, who also fired the boilers, said, "Everything was all rite here, but oi noticed oi had to shovel a helluva lot of coal from midnight on to kape stame up and the engine runnin!"

Experience With Magnetic Couplings For Induced-Draft Fan Drive

Two years' operation of 1000-hp variable-speed electric couplings indicates that their fundamental principles are sound, reports L M Exley, Long Island Lighting Company

▶ DURING FIRST trial runs of induced-draft fans of a 550,000-lb-per-hr boiler at Glenwood station (Long Island, N. Y.) one of two 1000-hp magnetic couplings overheated and froze. To avoid recurrence of this experience, a number of field tests have been run and modifications made to the installation, which should interest others who plan to use this type drive.

Our experience with magnetic couplings is limited to those manufactured by the Dynamatic Corp, of Kenosha, Wis. For induced-draft fan drive, these couplings are less costly to install than variable speed dc motors and provide a wider range of stepless speed control than wound-rotor ac induction motors. They are simpler mechanically than hydraulic couplings, have less time lag, normally use air for cooling instead of water and do not require the presence of relatively large quantities of oil in the high-temperature surroundings of the fan room.

The driving unit, an outer steel drum attached to a disk, is keyed to the motorshaft, (Fig. 2.) Several blades attached to the disk circulate cooling air. Within the drum, a series of air passages provides for cooling the metal in which heat is generated by eddy currents. The outside edge of the drum is supported, in part, by a removable skirt, or flange, which also helps direct air through the coupling.

The inner rotor, the driven unit, is shaped like a spur gear with teeth to provide greater magnetic tractive force. The air gap between driving and driven members is about 0.030 in. when the coupling is cold and increases as temperature rises.

The magnetizing coil, glass insulated, is wound peripherally around the driven member, with excitation current supplied through brushes and slip rings from an electronic unit consisting of two gas-filled grid-controlled rectifier tubes.

A make-and-break governor, geared to the driven shaft, cuts resistance in and out of the grid supply of the tubes and thereby determines the average value of pulsating dc excitation current of the coupling field. Tension on the reaction spring of the governor is varied by a cam positioned by the combustion control regulator. Excitation power ranges from ½ kw at low speed to a maximum of 2 kw.

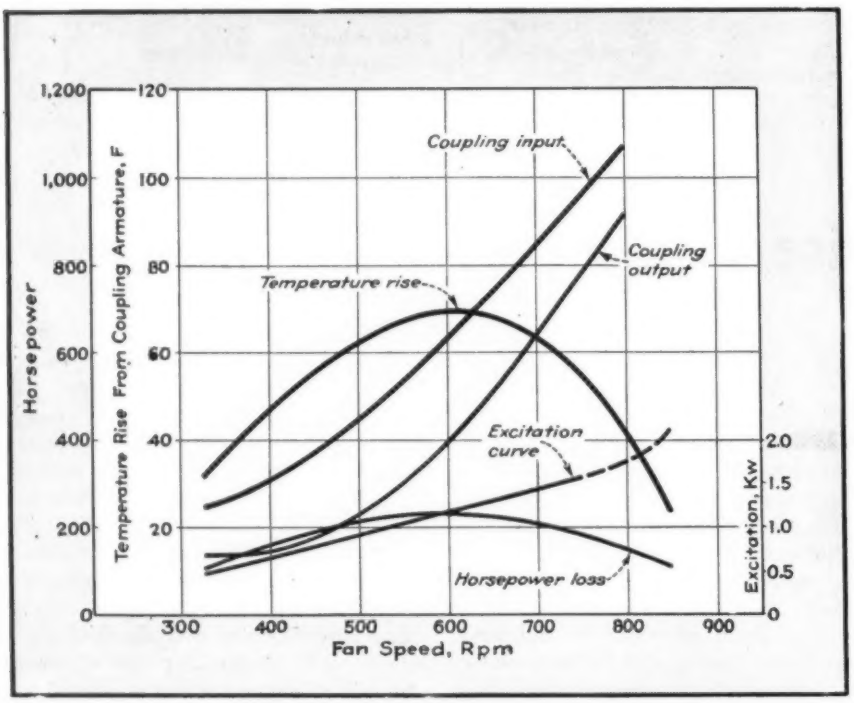


Fig. 1—Characteristic curves for magnetic coupling show that maximum temperature rise and horsepower loss occur at about two thirds of full speed on the fan

Tests Begun

After the experience of overheating and freezing of one coupling, the drum was remachined concentric and fan blades were installed on the disk to increase air flow. Thermometers were placed to read temperature of air discharge as a guide to actual metal temperature, which could not be conveniently measured directly.

The first series of tests demonstrated that the coupling would carry its guaranteed load but with an air temperature rise above 80 F, whereas 75 F was considered the top safe limit. It was also found that power required by the fans was 20 to 22% higher than the rated capacity of the couplings.

Guide vanes were installed in the right-angle bend of the inlet boxes on both sides of the fan to lower power requirements. Also, fins about 1 in. high and 4 in. wide were welded to the periphery of the coupling drum to increase flow of cooling air.

Guide vanes did not lower power requirements of the fan appreciably nor did the fins on the drum lower air temperature rise to any extent, so 1½ in. was burned off the tips of each of the fan blades. This lowered the required fan power to about 10% above normal rating of the coupling, which was agreed to be within the limits of what the coupling should be able to handle. However, the temperature rise of air through the coupling was still considered too high for safe operation.

Further study disclosed that air dis-

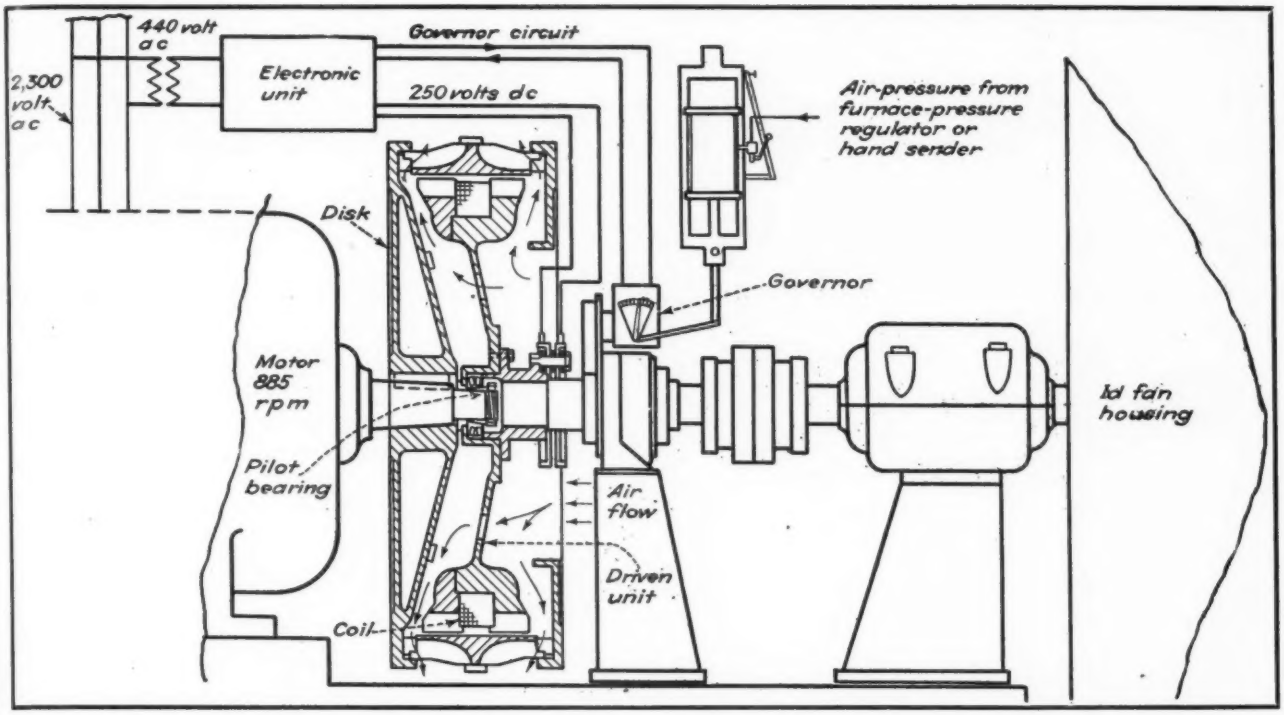


Fig. 2—Electronic unit produces direct-current excitation for magnet coil wound around driven member of coupling

charged from the coupling against the concrete foundation was being deflected back into the cooling-air inlet. To eliminate this recirculation, housings were installed around each coupling with ducts to carry hot air directly to the induced-draft fan discharge. This step also eliminated excessively high room temperatures prevailing when hot air was being discharged into the fan room.

With these changes the couplings have operated satisfactorily from a mechanical standpoint with a maximum temperature rise of 75 F. Since October, 1942, no mechanical maintenance has been required.

Exciter Units

Some troubles have been experienced with the electronic exciter units. Tube failures were attributed to high inverse peak voltages; mercury vapor-back rectifiers have corrected this trouble. Grid resistors of increased capacity have been installed.

The centrifugal governors are not rugged enough to maintain their adjustment or prevent excessive wear. Furthermore, the reaction springs must be adjusted in the field by trial and error to obtain proper operation of two fans in parallel. However, the manufacturer has developed an electronic governor utilizing a permanent-magnet ac generator with output voltage varying with the speed of the driven member of the coupling. After this voltage is rectified, control of the tubes is obtained by a potentiometer positioned by the combustion-control regulator. Plans are now in progress for installation of this governor of later design.

During test runs, fans have operated as low as 250 rpm, but in normal operation speed is seldom brought below 350 rpm. Fans can be accelerated from 250 rpm to 860 rpm in five seconds. At full speed the slip is 25 rpm, or approximately 3%.

Input and output curves of Fig. 1 were obtained from field tests during which accurate power measurements on the coupling itself were not possible. Power input to the motor was measured and corrected for motor efficiency to determine power input to the coupling. The curves are presented to indicate the general characteristics of the equipment and do not necessarily have the accuracy expected of complete performance tests.

Coupling Losses

Coupling losses were determined by measuring quantity of the cooling air being circulated through the coupling and the temperature rise of this air. Output was determined by subtracting losses from input.

Load averaged about 10% above coupling rating. Maximum loss, at approximately two-thirds full speed, amounts to 232 hp, or about 37% of input at this speed and load. Fig. 1 represents single-fan operation; losses and power are lower for 2-fan operation.

As a result of nearly two years of operation, even though considerable trouble has been experienced, we can say that the fundamental principles of the coupling are sound. The remaining troubles are of a nature which we believe will be entirely overcome by the installation of the electronic governor, resulting in a reliable, economical and simple method of fan control for steam-generating units.

U. S. COAL PROJECTS

The Bureau of Mines is working on projects that will (a) help relieve a huge and growing surplus of industrial sizes of anthracite that threatens to cut vitally needed production of domestic sizes unless new markets are found and (b) supplement available supply of industrial sizes of soft coals to help meet growing needs of war plants and other industries.

These projects, outlined before ASME's semiannual meeting, are: (1) burning mixtures of small anthracite and bituminous slack on stokers (2) methods of production and burning of "packaged fuel," from anthracite fines (3) anthracite fines in coke production (4) barley anthracite in many types of gas producers.

Solid Fuel Administrator Ickes said it was necessary to use about one million tons of freshly mined anthracite, from barley all the way down through the smaller sizes.

15 Years of 4-Mill Power—Ponca City's Diesel Record

What do detailed figures show? Bedrock operating cost in Oklahoma, and anywhere else, follows use of available low-grade fuel, topnotch operation and wide-awake maintenance

► IF THERE WERE SUCH A THING as a Distinguished Service Medal for diesel plants, Ponca City's, under Pat Schlesinger's direction, would undoubtedly rate one for the record of reliable low-cost operation it has hung up. When a POWER editor visited the plant this spring, complete data on its 15-year service had just been assembled. Here, we pass the record on to you and give some of the reasons behind it.

Ponca City, in Oklahoma's "Cherokee Strip," was founded in 1893, incorporated in 1899. Progressive spirit led to establishment of a municipal water system in 1902 and to a tiny steam power plant in 1912. This initial station consisted of a 75- and 100-kw steam-engine-driven generator, served by natural-gas- and oil-fired boilers. In 1917, a 200-kw. unit was added, followed by a 400 in 1919 and a 600 in 1921.

Located in the business district, the plant allowed of little further growth and no space for cooling towers. Continued increase in load led, in 1923, to installation of the first diesel. A 1250-hp unit, it permitted greater output in the restricted space and improved plant economy. Another 1250-hp diesel went in during 1925.

From 1922 to 1927, plant output nearly quadrupled and it became evident that the downtown plant site had reached the absolute limit of development. Thus, in 1928, the two existing diesels were moved to a building on the north side of town, where two new 1250-hp units were also installed, bringing capacity up to 5000 hp.

Plant Expansion

The new building provides for five units on 24-ft centers; crane heights and balcony levels are such as to permit installation of 3000-hp units, if necessary. Cooling system is rated at 1000 gpm, theoretically adequate for 4400 kw, or about 5850 hp.

In 1937, when it became evident that another unit was needed, a careful analysis of future growth, by Burns & McDonnell Engrg Co, of Kansas City, led to selection of a larger unit. A 2250-hp 2-cycle air-injection Nordberg engine, it represented the then current development of the basic design found in the four existing engines—all Nordbergs. It is anticipated that further plant expansion will add units of this size or larger, and retire the older, smaller units, one at a time, as they approach the end of a reasonable economic life, about 25 years. They still produce efficiently and could indefinitely but for the fact that it will probably prove more economical to use space for larger units.

The engines drive 2300-v 60-cycle 3-phase 0.8-pf ac generators—total capacity 4900 kw. The plant supplies a radial overhead distribution system. Load averages about half residential lighting, with commercial lighting and commercial and industrial power each representing about 20% of the total. Some output, about 4%, goes to the municipal pumping plant, and a little more than 1% to street lighting.

Rates have been established at a point slightly below the average of a number of surrounding communities, including both larger and smaller towns and municipal and private utility systems. The substantial profit earned by

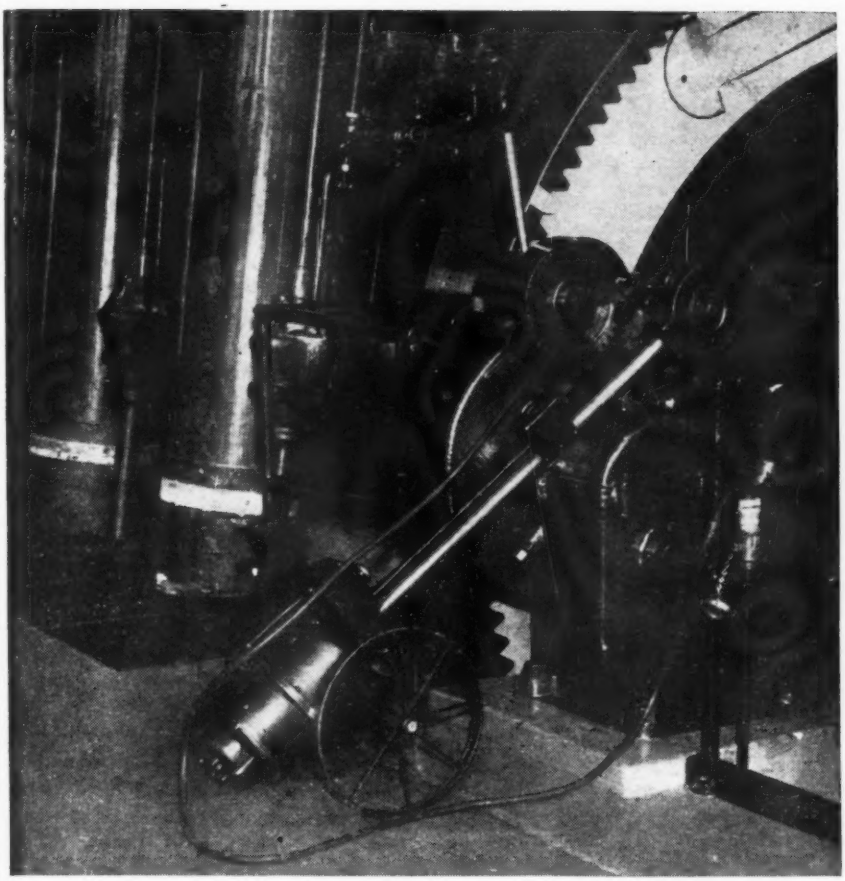
TABLE I—ENGINE OPERATING HOURS

Year ending June 30	Engine No. 1	Engine No. 2	Engine No. 3	Engine No. 4	Engine No. 5	Total
1929	5103	5728	2971	913		14,715
1930	5332	6155	2606	1473		15,566
1931	5572	6345	3167	736		15,820
1932	5261	5614	2444	1938		15,257
1933	5181	5765	2247	2616		15,809
1934	3600	4684	5104	3416		16,804
1935	3494	5608	5371	2809		17,282
1936	5083	6042	4568	2937		18,630
1937	4300	5827	4391	3188	769*	18,475
1938	1552	3015	2678	2975	6245	16,465
1939	3095	3716	1532	2606	6014	16,963
1940	2878	3467	3159	2703	5424	17,631
1941	2869	2677	2891	* 2285	6675	17,397
1942	2442	2605	3531	2316	7094	17,988
1943						
Total	55,762	67,248	46,660	32,911	32,221	234,802
Average	3983	4803	3332	2350	6288	3360

* *Operating hours for partial year not included in average*

TABLE II—OPERATING COSTS AND PRODUCTION

Fuel-oil cost	Lube-oil cost	Labor cost	Maintenance cost	Total operating cost	Production, gross kwhr
$16,633.55	$2690.65	$18,863.00	$3873.55	$42,060 75.	7,861,400
14,545.75	2283.70	19,101 75	2671.00	38,602.20	8,431,000
11,564.11	2740.00	19,768.50	2660.85	36,733.46	9,729,300
8,454.60	2287.41	18,662.50	1621.90	31,026.41	8,766,800
10,207.68	2336.14	15,512.50	2373.38	30,429.70	8,537,900
13,231.79	2391.37	17,060.00	3580.18	36,263.34	9,161,800
17,781.81	2158.88	16,509.00	3205.19	39,654.88	9,637,400
18,173.59	2002.90	15,934.00	3849.04	39,959.53	10,151,500
21,131.45	2408.96	16,476.67	4538.74	44,555.82	11,019,600
23,662.32	2169.19	18,930.00	3961.79	48,723.30	11,180,200
21,485.56	2250.15	19,680.00	2621.02	46,036.73	11,612,100
22,344.14	2440.34	21,627.00	3818.87	50,230.35	12,031,900
24,983.16	2448.10	21,125.51	3379.72	51,936.49	12,283,400
27,856.21	2542.91	21,017.05	3824.04	55,240.21	12,487,000
30,363.09	2603.66	20,385.30	3581.93	56,933.98	13,099,200
282,418.81	35,754.36	280,652.78	49,561.20	648,387.15	155,990,500
18,827.92	2383.62	18,710.18	3304.08	43,225.81	10,399,366



The familiar "power mule" used for threading large pipe finds a new application in Ponca City's diesel plant. Taking the place of the former hand crank, it forms a safe and convenient motor turning gear for older engines not so equipped

the light plant goes into the city treasury and, as a result, Ponca City is tax free. Bond issues, which have financed plant expansion to the present investment of $751,000, are being amortized and only a few are outstanding at this time. Plant and equipment are depreciated at 5%; a good portion has been written off and much small equipment (poles, line gear, etc) has been renewed on maintenance.

Tables below give plant operating cost in detail, engine operating hours, and unit costs on the various items of generating expense. Figures of cost, consumption and production come directly from the regular reports made up from conscientiously collected operating data. Unit costs were calculated from these figures by the POWER staff.

The figures reveal many interesting facts. The original engine, No. 1, operated more than 55,000 hr during the 15 years, and No. 2 operated over 67,000. Although not included in the table, records indicate that the original engine has turned out close to 50 million kwhr since its installation. The plant running capacity factor (total gross kwhr x 100 ÷ total rated kw of individual units) averages 67.8%.

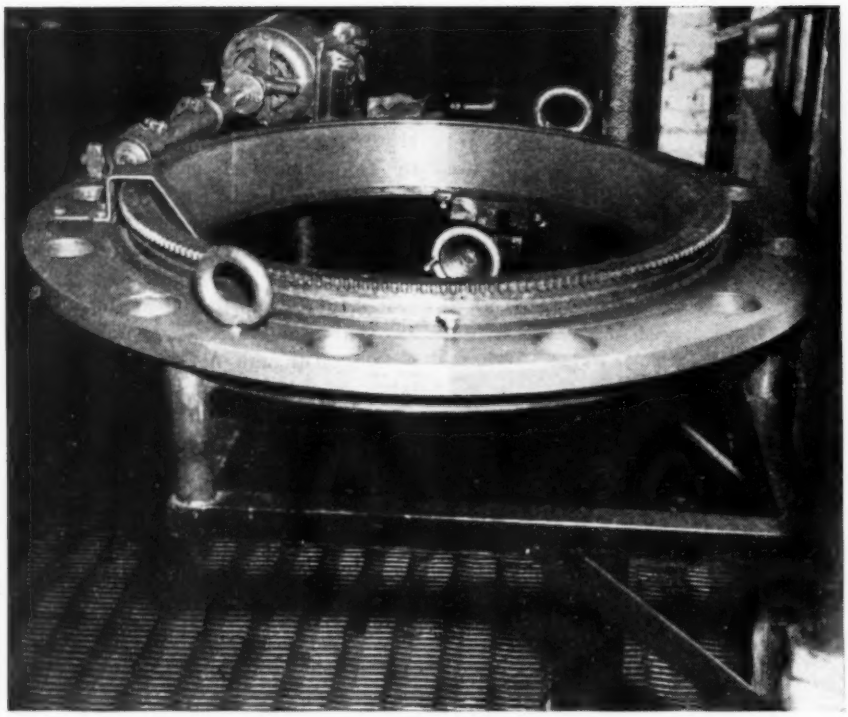
Fuel Costs Reduced

Looking at the costs, the fuel figures strike the eye immediately. An average of 1.90 cents per gal stands out as enviable, and undoubtedly the fact that the plant is only a mile or two by rail from Continental Oil Co's Ponca City refinery contributes to the low operating cost. But credit goes to the plant management for taking the steps necessary to use advantageously the low-grade fuel available at these good prices.

When Pat Schlesingner first came to Ponca City in 1926, the plant was operating on 24-26 gravity oil, which was relatively expensive. From experience with Mexican crudes in Phelps-Dodge mine power plants in the Southwest, Schlesinger knew the heavier oils could be handled and a substantial saving made. An agreement with the refinery secured for the plant a supply of heavy

TABLE III—UNIT CONSUMPTION AND OPERATING COST DATA

Year ending June 30	Production, gross kwhr (thousands)	Fuel consumption		Fuel cost		Lube-oil consumption			Lube-oil cost		Labor cost, ¢/kwhr	Maint cost, ¢/kwhr	Total cost, ¢/kwhr	Year ending June 30
		gal	kwhr/gal	¢/gal	¢/kwhr	gal	kwhr/gal	Rated hphr gal	¢/gal	¢/kwhr				
1929	7861	774,692	10.14	2.47	0.212	2744	2865	6703	98.06	0.034	0.239	0.049	0.535	1929
1930	8431	818,331	10.28	1.77	0.173	3305	2551	5887	69.09	0.027	0.227	0.032	0.458	1930
1931	9729	859,854	11.27	1.73	0.119	3677	2646	5393	74.51	0.028	0.214	0.027	0.378	1931
1932	8767	850,763	10.28	1.35	0.096	4234	2071	4504	53.82	0.026	0.173	0.019	0.354	1932
1933	8538	852,520	10.01	1.00	0.120	4150	2057	4762	56.29	0.027	0.182	0.028	0.356	1933
1934	9162	899,922	10.19	1.19	0.144	4504	2034	4664	53.09	0.026	0.186	0.039	0.396	1934
1935	9637	934,888	10.31	1.90	0.185	4024	2395	5368	53.65	0.022	0.171	0.033	0.411	1935
1936	10,152	995,646	10.20	1.83	0.179	4126	2460	5644	48.54	0.020	0.157	0.038	0.394	1936
1937	11,020	1,093,072	10.08	1.93	0.192	5159	2136	4625	46.69	0.022	0.150	0.041	0.404	1937
1938	11,180	1,059,771	10.54	2.23	0.212	5349	2090	5015	40.55	0.019	0.169	0.035	0.436	1938
1939	11,612	1,075,839	10.79	2.00	0.185	5056	2297	5383	44.50	0.019	0.169	0.023	0.396	1939
1940	12,032	1,097,020	10.97	2.04	0.186	5538	2173	4959	44.06	0.019	0.180	0.032	0.417	1940
1941	12,283	1,140,065	10.77	2.19	0.203	5690	2159	4995	43.02	0.020	0.172	0.028	0.423	1941
1942	12,487	1,155,828	10.80	2.41	0.223	5734	2178	5159	44.34	0.020	0.168	0.031	0.442	1942
1943	13,099	1,250,781	10.47	2.43	0.232	6192	2116		42.04	0.020	0.156	0.027	0.435	1943
Total	155,991	14,858,992				69,482								
Average	10,399	990,600	10.50	1.90	0.181	4632	2245	5147	51.45	0.023	0.180	0.032	0.416	



This device was built to smooth and true the joint between cylinder and liner, insuring a good gasket surface. The cast frame fits over the cylinder-head studs and carries the toothed rotating ring on which a salvaged lathe carriage mounts. Chevrolet timing gears, opened out and bent to proper curvature, fasten to the ring to form the teeth. A motor-driven worm turns the ring; a star feed advances the cutting tool at each revolution and a wedge provides adjustment for depth of cut

oil (8-10 deg Baume) at about half the cost of former fuel.

Having air-injection engines, operating at relatively low speed (180 rpm on four older machines, 225 rpm on latest unit), the only change to handle the heavy oil successfully was in the atomizers. With enlarged openings they will handle oils from 8 to 28 deg Baume. Experience over the years indicates that fuel consumption in kwhr per gal might run 10 or 15% better than the 10.5 average actually attained, if lighter and better oil were used, but fuel-cost saving outweighs this so far as to make it negligible. Contrary to what might be expected, burning low-grade fuel hasn't boosted maintenance cost, which has averaged 0.318 mills per kwhr, or 61 cents per installed hp per yr. Both figures are good enough to put the plant into the low-maintenance-cost class, regardless of fuel type. A comprehensive analysis of maintenance costs for nine years, from 1929 through 1937, was published in POWER, May 1938, p 56.

Present fuel-oil price, which averaged 2.43 cents per gal in 1943, reflects the general increase in all fuels, particularly petroleum products. A typical fuel analysis runs:

Gravity, deg Baume	9.2
Flashpoint, F	265
Firepoint, F	320
Pourpoint, F	-5
Conradson carbon, %	9.75
Sediment, %	0.4
Sulphur, %	0.48
Viscosity, SSU at 100 F	452
Heating value, Btu per lb	18,047

Highly developed operating and maintenance routines also contribute to the plant's low-cost record. On each shift, there are two operators whose sole responsibility is operation; two additional men on the day shift handle all maintenance and repair work. Without overly increasing the plant crew, this arrangement permits the engineers to concentrate on the regular operating routine and puts mechanical work in the hands of trained men. A day-shift janitor brings the total force to nine men. He it is who keeps the plant in spotless shape, which, according to Schlesinger, means better all-round operation.

While maintenance follows a definite schedule, its progressive basis means that no machine is out of service more than a few hours at a time and all are available for the daily peak load. Approximately every 3000 hours, valves are replaced, working on one cylinder at a time. Those that are removed receive thorough reconditioning and go back into stock. This rotating procedure of removal, replacement and reconditioning for stock applies to all small engine parts.

Piston inspection takes place about twice a year. One or two pistons are pulled during the day, inspected and returned to service in time to put the engine on the line for the night load. For each engine, a record book carries the full story on condition and service life of piston rings. Liner-wear measurements are also carefully recorded.

Engine size and use of the progressive rather than an overhaul system of maintenance requires that crankshaft and bearing checks be made with the shaft in place. About once a month, main, crankpin and crosshead bearings get a hammer test and a clearance check. That regular inspection and adjustment pay is demonstrated by the fact that all engines still run on the original main bearings. In the old engines all crank bearings have been rebabbitted while about 40% of those in the new engine have been relined.

Maintenance men make a complete check of crankshaft alignment every three years, using feelers, strain and bridge gages. They plot readings on the usual form of crankshaft diagram to detect any deformation.

To keep combustion conditions at the level required for good engine performance, operators indicate each engine about once a month, or oftener if necessary. For convenience in studying the combustion period, they usually take pull cards, but all engines are fitted with indicator motions to obtain pressure-volume cards.

Complete Parts Stock

The carefully laid out stockroom in the basement has a full supply of spare parts. Stock includes even large items, such as crossheads, bearings and pistons, in fact, enough for quick repair of practically anything but a crankshaft failure. The small shop on the plant operating floor proves adequate because the facilities of the Nickles-Schwenk Machine Corp, Ponca City specialists in diesel-engine and heavy equipment repairs, are available for work such as relining bearings.

Considerable ingenuity has gone into special equipment to facilitate operation and maintenance. The photo on page 73 shows how a "power mule" has been adapted as a turning gear for the older engines; on this page is the photo of a homemade device for surfacing the joint between the cylinder and liner to insure proper gasket seating.

How to Convert a Gas Analysis

1—From volume basis to weight basis
2—From weight basis to volume basis

By E N KEMLER
Professor, Mechanical Engineering
Purdue University

▶ FOR COMBUSTION CALCULATIONS and other purposes it is often necessary to convert a gas analysis from percents by volume to percents by weight, and vice versa. This article explains an easy tabular method of conversion in either direction.

The starting point is Avagadro's Law: *All gases at a given temperature and pressure have the same number of molecules in the same volume.* It follows that the weights of equal volumes of gases must be proportional to their molecular weights.

The mol is a very convenient measure of gas. It is a quantity such that its weight in pounds is the same *number* as the molecular weight. For example, the respective molecular weights of carbon dioxide, nitrogen and oxygen are 44, 28 and 32. Then, a mol of carbon dioxide is 44 lb, a mol of nitrogen is 28 lb and a mol of oxygen is 32 lb. All three have the same volume, and it will be the same for any other true gas. At standard conditions of 14.7 psi abs and 70 F, the volume of one mol of any true gas is 386 cu ft.

The weight, in pounds, of any quantity of gas equals the number of mols times the molecular weight. Thus, 5 mols of oxygen weigh $5\times32=160$ lb.

Table I lists the approximate molecular weights of the elements commonly found in combustion problems. Note that the elemental gases have two molecules each. The molecular weights of compounds are easily found from this table. For example, CO_2 contains one molecule of carbon and one molecule of oxygen, so its molecular weight is $12+32=44$. On the other hand, CO has only ½ molecule of oxygen, so its molecular weight is $12+16=28$.

From Volume to Weight Basis

Table II illustrates the conversion of a volumetric analysis to a weight analysis. The squares between columns 4 and 5 would not ordinarily be used, but are inserted to make what is happening clearer. Each square represents one mol, also one volume.

Columns 1, 2 and 4 are the given volumetric analysis. To get the actual weight (col 5) of any constituent, multiply its molecular weight (col 3) by the number of mols (col 4). To get the *percentage* by weight of each constituent, multiply its weight by 100 and divide by the total weight.

Consider the SO_2, for example. Its molecular weight is 64, and it is 20% of the gas sample, by volume. Then (col 4) it must be 20 mols in 100 mols of mixture. One mol of SO_2 weighs 64 lb (same number as the molecular weight), so 20 mols must weigh $64\times20=1280$ (col 5).

Column 5 totals 3720 lb for 100 mols of the mixture, so the percentage of SO_2 by weight must be $100\times1280\div3720=34.4\%$.

From Weight to Volume Basis

Table III illustrates the conversion of an analysis from weight basis (col 3) to volume basis (col 6). For convenience, assume a 100-lb sample. Then weights in pounds (col 4) are the same as percentages by weight (col 3).

In the case of N_2, the molecular weight is 28. The percent by weight is 50; so weight (col 4) is 50 lb in 100 lb of sample. Since one mol weighs 28 lb (same number as molecular weight) the number of mols present is $50\div28=1.786$. Since mols are volumes, the percent by volume is $100\times1.786\div3.308=54.0\%$.

Equivalent Gas Properties

In the calculation of gas properties it is frequently desirable to know the equivalent molecular weight of the mixture. To get this, divide the total weight of the actual or assumed sample by the total number of mols it represents. Thus, the gas of Table II will have an equivalent molecular weight of $3720\div100=37.2$. In Table III, the gas will have an equivalent molecular weight of $100\div3.308=30.2$.

Table II—Conversion from Volume Basis to Weight Basis

1 Constituent	2 Formula	3 Mol wt	4 % by vol (= mols)		5 Total wt lb	6 % by wt
Sulphur dioxide	SO_2	64	20	(each 64 lb)	1280	34.4
Carbon monoxide	CO	28	10	(each 28 lb)	280	7.5
Carbon dioxide	CO_2	44	10	(each 44 lb)	440	11.9
Oxygen	O_2	32	10	(each 32 lb)	320	8.6
Nitrogen	N_2	28	50	(each 28 lb)	1400	37.6
Total			100		3720	100.0

Table I—Molecular Weights

Constituent	Formula	Mol wt	Constituent	Formula	Mol wt
Carbon	C	12	Sulphur	S	32
Oxygen	O_2	32	Hydrogen	H_2	2
Nitrogen	N_2	28			

Table III—Conversion from Weight Basis to Volume Basis

1 Constituent	2 Mol wt	3 % by wt	4 Wt, lb.	5 Mols (volumes)	6 % by volume
N_2	28	50	50	1.786	54.0
CO	28	10	10	0.357	10.8
CO_2	44	10	10	0.227	6.9
O_2	32	30	30	0.938	28.3
Total		100	100	3.308	100.0

Keep Up Compressor Output by Holding

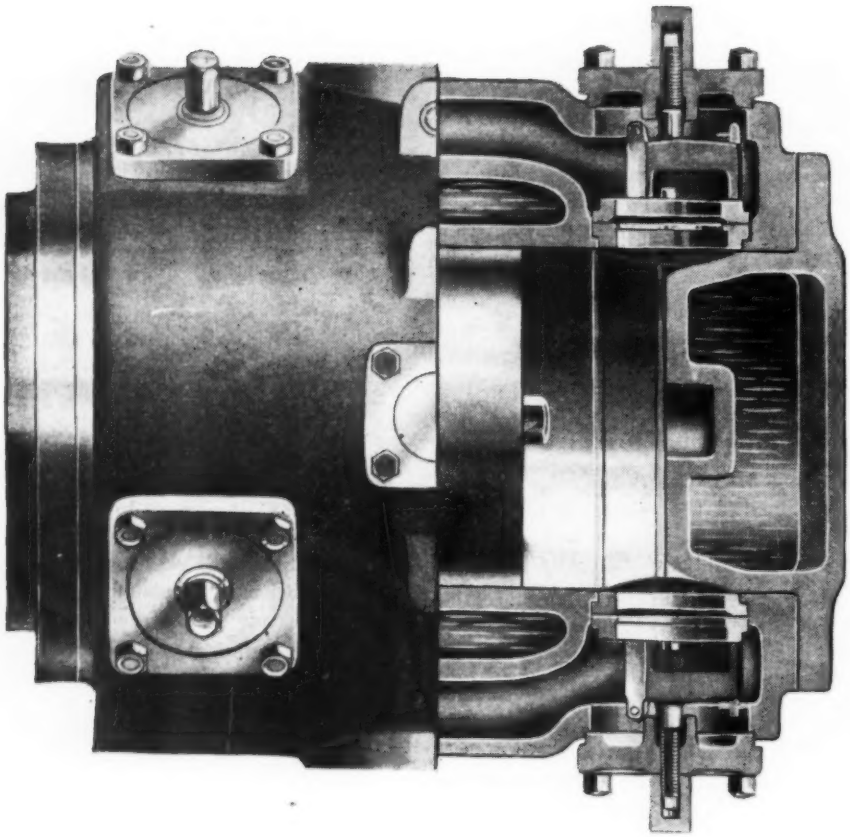


Fig. 1—Maximum separation of intake and discharge passages, and adequate cooling-water jackets keep air from being heated excessively when it enters

► DETERMINING AIR-COMPRESSOR CAPACITY would be relatively simple if a non-compressible, non-expansible fluid were handled. The quantity delivered into the discharge line would be practically equal to the volume swept by the piston. However, since air or gas is elastic, any compressor's capacity varies widely as pressure conditions change. For instance, with a given intake pressure, a machine's capacity is considerably less when discharging at 100 than at 50 psi. This makes it impossible to rate a given compressor for a given capacity. The only practicable rating is in terms of piston displacement—volume swept by the moving piston during one minute. A *volumetric efficiency*, which varies for different compression ratios, must then be applied to the piston displacement to determine actual free-air capacity. Volumetric efficiency also varies to some extent with the *n* value of the gas being compressed.

Greatest volumetric loss occurs because of clearance within the compressor cylinder. However, other losses, while of lesser importance, also affect compressor capacity. Let's investigate the losses and see how they reduce output.

Clearance loss. When the compressor piston reaches the end of its stroke and has discharged all the air it can, a small amount remains in the valve pockets and clearance space between piston and cylinder head. When the piston starts its return stroke, this clearance air (at discharge pressure) must expand to intake pressure before inlet valves can open; thus no air enters the cylinder for that portion of the stroke, which reduces the intake volume by that amount. Since the volume of this clearance air, expanded to intake pressure, varies with the compression ratio, it follows that a compressor's volumetric efficiency, and hence its actual capacity, varies with compression ratio, and not with pressure.

A single-stage compressor with atmospheric intake, discharging at 100 psi, works through 7.8 compressions (divide absolute discharge pressure of 114.7 psi by absolute intake pressure of 14.7 psi). However, high-pressure air left in the clearance space does

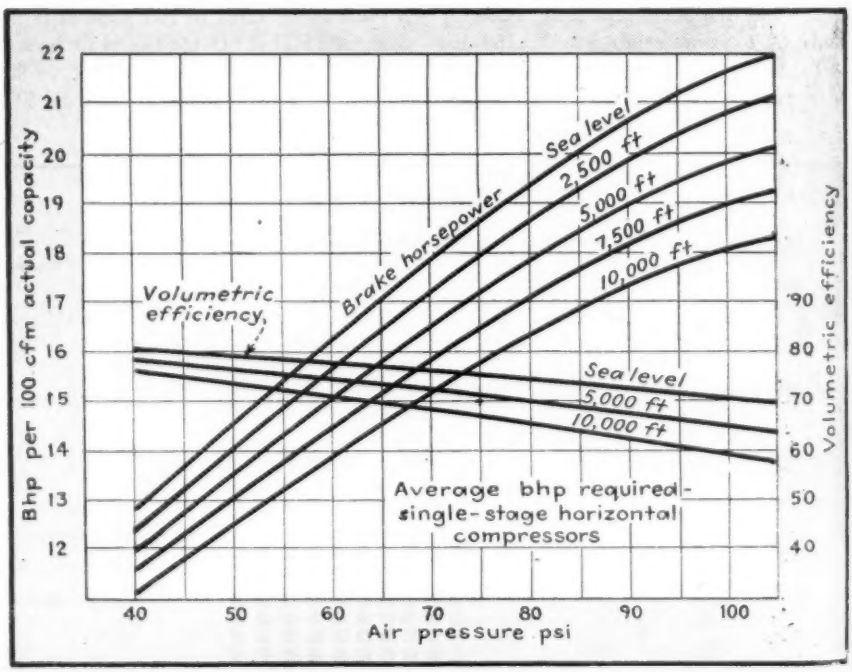


Fig. 2—Greatest volumetric loss occurs because of clearance between piston and cylinder head. Volumetric efficiency falls off as discharge pressure increases

Down Preventable Losses

Excessive leaks and poor cooling eat up a large part of rated capacity if they are not corrected promptly. The more general causes of poor machine performance are here outlined by H H Miller, Worthington Pump & Machinery Corp

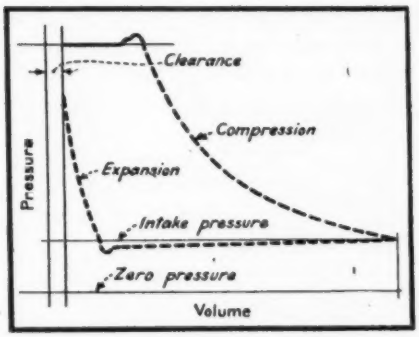


Fig. 4—When piston starts its return stroke, clearance air must expand to intake pressure before intake begins

not expand 7.8 times while piston makes its return stroke; instead, the expansion line falls somewhere between isothermal and adiabatic expansion curves because the air gives up heat as it acts on the piston. Exact position of clearance expansion line varies slightly with cylinder design and other characteristics.

Assume that clearance air expands to 5 times its volume, and cylinder clearance is 5%. Then volumetric loss from clearance may be expressed by (5–1) x5, or 20%, equivalent to a compressor indicated volumetric efficiency of 80%. Thus, if the piston displacement is 500 cu ft, the indicated actual capacity is about 400 cu ft. One volume is subtracted from the number of compression ratios because, when clearance air expands to intake pressure, one volume remains in the clearance space.

Heating intake air as it passes into the compressor cylinder before intake valves close causes the air to expand, so that less weight of air goes into the cylinder. Manufacturers base compressor capacity on air temperature at the cylinder intake flange; therefore any loss from heating the air as it passes through ports and valves is chargeable against the compressor.

Weight of air handled varies inversely as the absolute temperature, so that, if the ambient temperature at cylinder-intake flange is 60 F and the air is heated 20 F in passing into the cylinder, weight in the cylinder when compression starts is $\frac{520}{540}$ of its original value, or 96.3%—equivalent to volumetric loss of 3.7%.

Poorly designed cylinders that run hot have low volumetric efficiency. Remember the high-pressure tire pump? It pumped up the first tire rapidly, but by the time you reached the last tire the pump was so hot it delivered scarcely any air. This was because the heated intake air rapidly increased the discharge temperature, which in turn cumulatively increased intake temperature until only a small weight of air entered.

Best efficiency is obtained from compressors with carefully designed intake ports and valves far removed from the hot discharge, to provide the coolest intake-air passage possible. Slight heating of entering air is unavoidable.

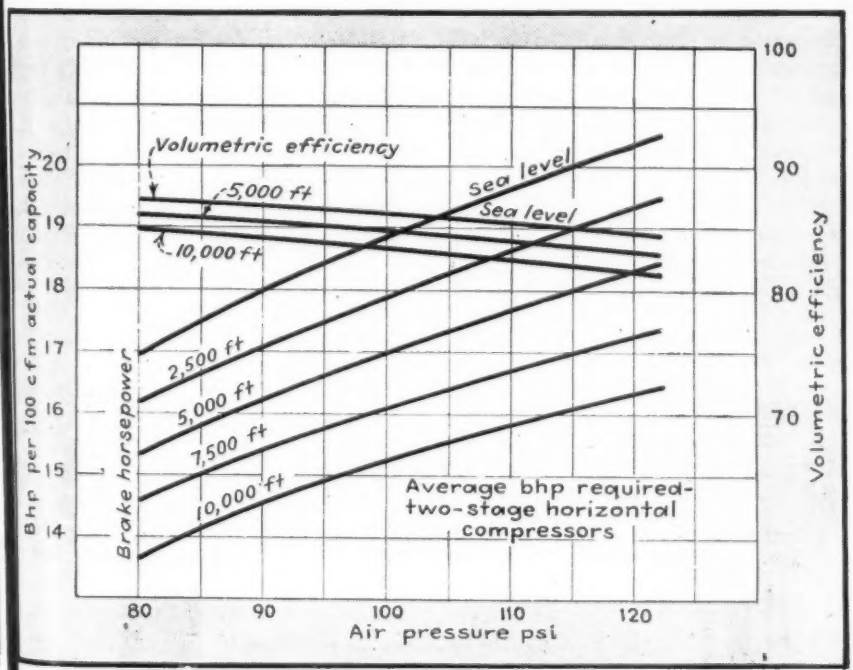


Fig. 3—Increased volumetric efficiency of 2-stage compressing, plus the intercooling, saves input horsepower. Compare these curves with those given in Fig. 2

Base-Water Temperature

Effect of cooling water. Since its temperature has a marked effect on the cylinder-metal temperature, a base must be established from which to calculate both volumetric efficiency and horsepower performance. The compressor industry uses a cooling-water temperature 20 F colder than incoming air, performance calculations being referred to this value not only for single, but also for multi-stage compressors. With the latter, assume that properly designed intercoolers cool the first-stage air down to the temperature of the low-pressure intake air (perfect intercooling). Obviously, when cooling water is warmer than incoming air, cylinder-wall temperatures are higher and the air is heated slightly more in passing into the cylinder. This effects a slight decrease in volumetric efficiency. Likewise, the warmer jackets also slightly increase the horsepower required by the compressor.

Valve leakage. Leakage through intake valves occurs only during the compression stroke. Such leakage allows air that should be compressed and discharged to pass back into the intake pipe. Leakage through discharge valves during the intake stroke allows high-pressure air to pass back into the cylinder at a time when inlet valves are open, thus lowering volumetric efficiency. Obviously, discharge-valve leakage during the compression stroke,

occurring before the discharge valves open, results in a steeper compression curve and increases horsepower input.

Piston-ring leakage allows air from the compression chamber to pass by the piston into the other end, which is then taking suction with inlet valve open. Capacity is reduced because this hot leakage air heats up the incoming air in that end of the cylinder. Naturally, maximum piston leakage occurs as the piston approaches the end of its stroke because differential pressure across the rings and the time element are greatest. This leakage causes both a volumetric and horsepower loss as evidenced by an increase in discharge temperature.

Valve slip means reversed air flow through valves before they have had time to seat at end of piston stroke. Obviously, this is a volume loss that can occur through both intake and discharge valves. Minimum slippage occurs in a responsive valve; one that has minimum inertia so that the moving element easily can be controlled by air flow. Slip is usually much less through intake than through discharge valves. In the latter, differential pressure across the valve increases rapidly as the piston turns dead center, so that, if the valve does not respond instantaneously, high-pressure air naturally returns through the valve before it seats.

Effects of Two-Staging

Two-stage compression has a marked effect on volumetric efficiency. Here the low-pressure cylinder largely determines the entire machine's volumetric efficiency because whatever volume this cylinder delivers to succeeding stages must be discharged by them, except slight leakage through stuffing boxes. In other words, volumetric efficiency of a 2-stage compressor is the same as though the low-pressure cylinder was a single-stage compressor delivering air at intercooler pressure.

For example: A 21x13x14-in. 2-stage machine with a piston area ratio of 2.6 compresses to 100 psi. Therefore, if low- and high-pressure inlet temperatures are the same, discharge pressure of the low-pressure cylinder becomes (cylinder ratio — 1) x absolute intake pressure of 14.7 psi, or here, 23.5 psi gage. Assuming no appreciable leakage this compressor's volumetric efficiency may be calculated as that of a 21x14-in. single-stage machine discharging at 23.5 psi gage.

Unless intercooler water is 20 F colder than intake air temperature, air entering the high-pressure cylinder is somewhat hotter than the low-pressure intake air. If the latter is 70 F but intercooler cools the air to only 90 F, intercooler air pressure is above normal by the ratio of absolute temperatures, thus:

$$23.5\text{-psi gage or } 38.2 \text{ psi abs} \times \frac{550}{530} = 39.7 \text{ psi abs or } 25\text{-psi gage}$$

Excessive air velocities in the intercooler causes considerable pressure difference across it and produce a lower pressure at the high-pressure cylinder intake. Thus the low-pressure cylinder must build up additional pressure before the high-pressure cylinder will take away the necessary quantity of air.

Before calculating intercooler pressure make certain that clearance percentages in the two cylinders are about equal. Any appreciable difference changes the effective cylinder ratio from the nominal ratio of piston area. Actually, here the cylinder ratio must be based on the effective areas of the cylinders, and the true ratio may be expressed by:

$$\frac{\text{L–P piston area} \times \text{L–P volumetric}}{\text{H–P piston area} \times \text{H–P volumetric}}$$

Instead of basing cylinder ratio on the net cylinder areas (deducting piston rod) base it on the actual capacities of two cylinders, which are largely determined by cylinder clearances. Normally, 2-stage 100-psi compressors should have little difference in the clearances of the two cylinders. Discrepancy is more often observed in smaller 2-stage machines operating at pressures of 200 psi or higher.

Assume a 12x6x10-in. 2-stage compressor discharging at 300 psi. Nominal cylinder ratio is 4 and intercooler pressure should be about 44-psi gage if intercooler cools the low-pressure air back to intake temperature and percentage of clearance of the two cylinders is approximately the same. Suppose low-pressure cylinder has 6% and high-pressure 12% clearance. Obviously, the large clearance in high-pressure cylinder reduces its capacity. Therefore it will not take away the air volume of low-pressure cylinder until the intercooler pressure builds up and forces a low-pressure-cylinder volume of air into high-pressure cylinder. Suppose the intercooler pressure must increase to 50 psi, volumetric efficiency of the low-pressure cylinder (having 6% clearance and operating against this pressure) is 82%. With the high-pressure cylinder taking air at 50-psi gage and discharging at 300-psi gage, ratio of compression in that cylinder is:

$$\frac{314.7}{64.7} \text{ or } 4.86$$

Approximating volumetric efficiency of high-pressure cylinder, with a clearance of 12% and discharging at 4.86 compressions, we find 67% a reasonable figure against 82% for the low-pressure cylinder. Applying these figures to determine the effective cylinder ratio (method described previously) we find the nominal ratio of 4 becomes:

$$\frac{113 \times 0.82}{28.2 \times 0.67} = 4.9 \text{ effective ratio}$$

This increases the theoretical intercooler pressure of 44 psi to about 57-psi gage, assuming that the high-pressure intake air is cooled to the temperature of low-pressure intake. We have not accounted for the piston rod, whose area must always be subtracted from cylinder area for accurate results.

Many factors enter into the determination and control of volumetric efficiency. Some of these are governed by natural laws, while others can be controlled by careful compressor-cylinder and valve design. Indicator cards from cylinders do not show true volumetric and actual capacity delivered by the compressor. The approved method of determining capacity is by low-pressure orifice measurements, an authentic description of which is covered in Section 4, Part 1, *Trade Standards of the Compressed Air Institute.*

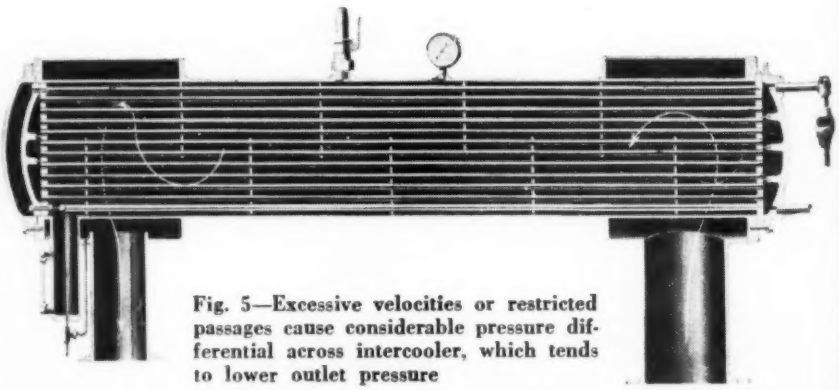


Fig. 5—Excessive velocities or restricted passages cause considerable pressure differential across intercooler, which tends to lower outlet pressure

Explosion-Proof Motors for Hazardous-Gas Locations

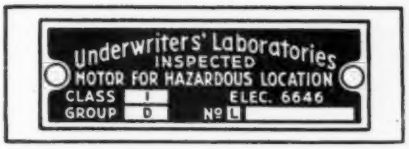


Fig. 1—Electric motors that bear this tag are suitable for operation in an atmosphere where gasoline, naphtha or other explosive vapors are present

By EDWARD F WEHLAGE *Plant engineer*

Here are the National Electrical Code Classifications of hazardous gases and dusts, with a plant engineer's description of the construction features of explosion-proof electric motors that are safe for these applications. His recommendations are based on extensive experience with electric-motor operation where explosive gases are present

NATIONAL ELECTRICAL CODE CLASSIFICATIONS OF HAZARDOUS-GAS AND DUST LOCATIONS

CLASS I

GROUP A	*Atmosphere containing acetylene*
GROUP B	*Atmosphere containing hydrogen, or gas or vapor of equivalent hazard, such as manufactured gas*
GROUP C	*Atmosphere containing ethyl-ether vapor*
GROUP D	*Atmosphere containing gasoline, petroleum, naphtha, alcohol, acetone, lacquer-solvent vapors and natural gas*

CLASS II

GROUP E	*Atmosphere containing metal dust*
GROUP F	*Atmosphere containing carbon black, coal or coke dust*
GROUP G	*Atmosphere containing grain dust*

▶ WHEN CONVENTIONAL ELECTRICAL MOTORS and controls operate where inflammable liquid, vapor or gas is present, fires and explosions may jeopardize life and property without warning. Because of explosive substances in the atmosphere, which sparks or heat from electrical equipment may ignite, these hazards are ever present in such industries as petroleum refineries and pumping stations, chemical plants, dry-cleaning establishments and coal mines. They are present, too, wherever there is metal, grain or coal dust, but the more common and serious hazardous atmospheres result from alcohol, petroleum, acetone, lacquer solvents and natural gas. Guard against all these substances by installing electrical equipment designed to operate safely in such locations.

All electric motors fall into two groups: (1) *Sparking:* This group includes designs that have brushes, short-circuiting devices or slip rings. In normal operation they produce sparks, which make their use dangerous in hazardous locations unless motor construction is explosion proof. (2) *Nonsparking:* Polyphase squirrel-cage induction motors do not represent a continuous hazard when operated in the presence of inflammable liquids and vapors, but their insulation may fail or they may overheat. Consequently, do not rely on open motors of any class if inflammable vapor or gas is present.

For many years, fire insurance companies and city building-inspection departments prohibited electric-motor installations for operation in the presence of inflammable vapors and liquids. Such equipment had to be segregated in non-hazardous locations. However, manufacture and use of volatile substances became so extensive in industrial practice as to make it impracticable to isolate electrical equipment from these processes.

Attempts to construct so-called vapor-tight inclosures for electrical equipment failed to solve the problem. Inclosing motors in gas-tight cases to exclude dust and inflammable vapors from their winding might appear to be a solution of operating them safely in hazardous atmospheres, but experience shows that it is practically impossible to build hermetically sealed motors. Eventually gas seeps into them, particularly at the shaft seals, even though they were tight when assembled. Because of this difficulty motors for operation in hazardous locations are designed to pre-

vent flame propagation to the surrounding atmosphere from an explosion inside them. Such motors are known as explosion proof.

All commonly known hazardous locations have been classified in Article 500 of the National Electrical Code after study of maximum pressure developed by explosion in motors by various gas mixtures, as given in the table, page 79. Group A, Class I, is for atmospheres containing acetylene, which is the most hazardous. Other classifications range downward in explosion hazard in the order given.

Dust-tight and similar totally inclosed motors are designed for certain hazardous conditions but are not constructed for or approved for Class I service. Pipe-ventilated motors are designed for circulation through them of clean air from non-hazardous locations, which maintains a safe atmosphere in and around them. They are intended for operation in Class II location, given in the table, and usually are not constructed to permit their use in Class I areas.

Explosion-proof motors for any Class I service have totally inclosed housings of sufficient strength, including additional bolts, to safely stand an internal explosion, without permitting flame to reach the outside. Leads are sealed where they pass through the motor housing and terminate in an explosion-proof junction box.

Most frame sizes of these motors require fan cooling, which calls for a double-shell, Fig. 2. Inner housing resists interior explosions and outer shell forms a duct, through which the fan circulates cooling air. The inner housing may have fins to accelerate transmission of heat from the motor frame to the cooling air. All frame joints of these motors have amply wide machine fits and close-clearance sleeves long enough around the shaft to prevent escape of flame or sparks from inside the motor during an explosion. They also have sufficient thermal capacity to prevent their frames reaching a temperature that would ignite surrounding gas from an internal explosion, or even from a complete burnout of their windings.

Explosion-proof motors are usually rated 55-C temperature rise, compared to 40 C for standard-duty open motors. Motors meeting the requirements of

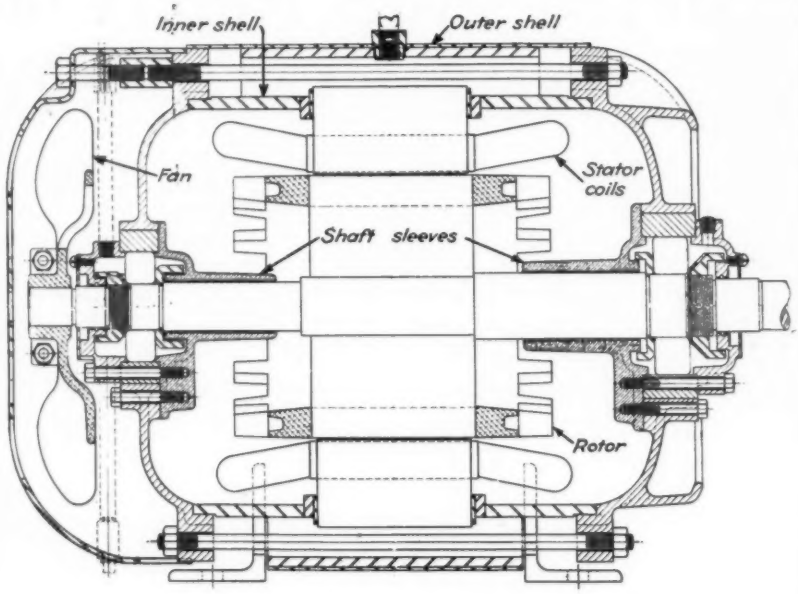


Fig. 2—Totally inclosed, fan-cooled explosion-proof motor underwriters approved for operation in Class I, Group D, hazardous-gas locations

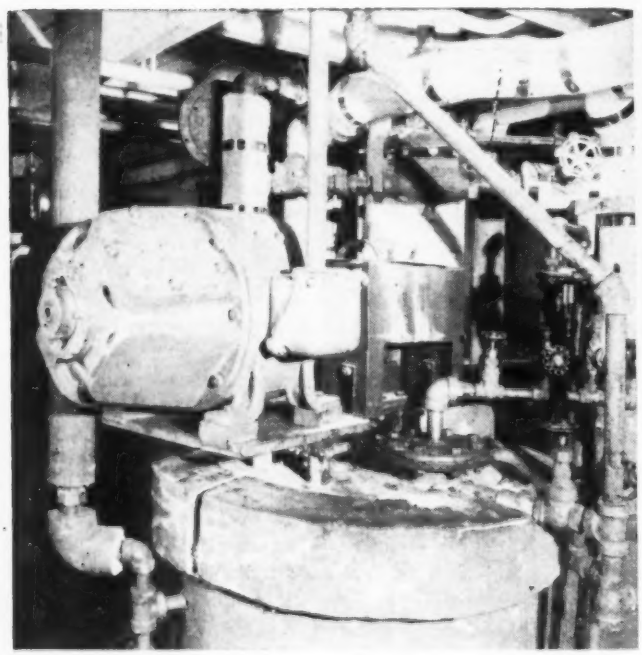


Fig. 3—Explosion-proof 230-v 1735-rpm dc motor for Class I, Group D of hazardous-gas locations drives a reaction kettle in a varnish plant. Electronic speed control for motor is located in a clean, adjoining room away from explosive gas

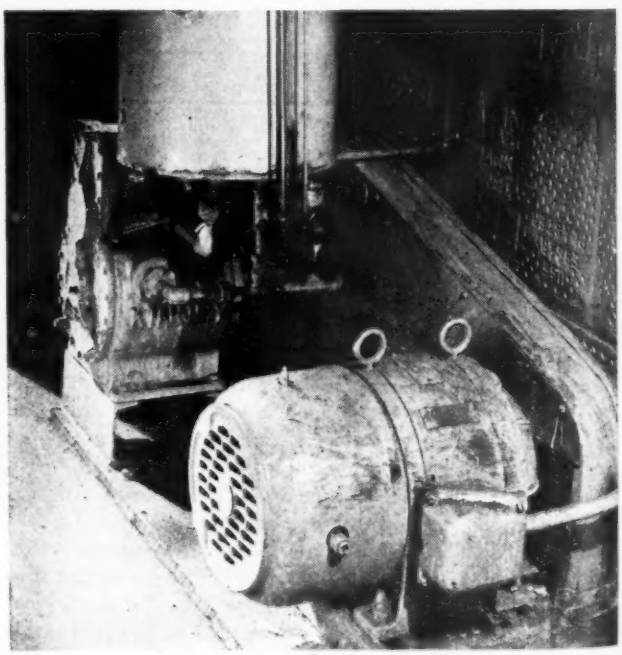


Fig. 4—Explosion-proof 2-hp 220-v 1735-rpm squirrel-cage induction motor for hazardous-gas Class I, Group D locations, connects to a rotary-plunger vacuum pump through an inclosed silent chain drive in a varnish manufacturing plant

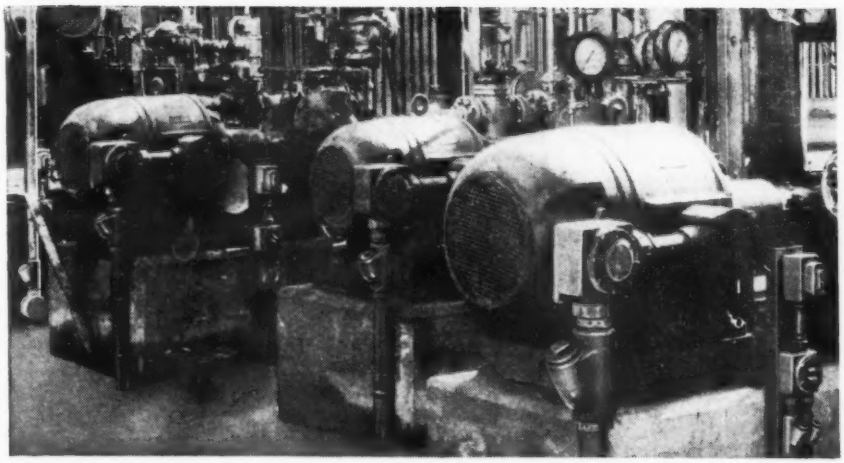


Fig. 5—In this hazardous-gas location, note that in addition to the explosion-proof motor all the electric fittings are made gas tight and explosion proof

paragraph 5016 of the National Electrical Code, which reads "Motors and generators shall be of types approved for use in explosive atmospheres," usually carry an underwriters' label such as Fig. 1. This indicates that the motor is suited for applications in the atmosphere stamped on its label. The label in Fig. 1, on a motor, shows that it is built for Group D, Class I, conditions, that is, atmospheres containing gasoline, petroleum, naphtha, alcohol, acetone, lacquer solvent vapors or natural gas.

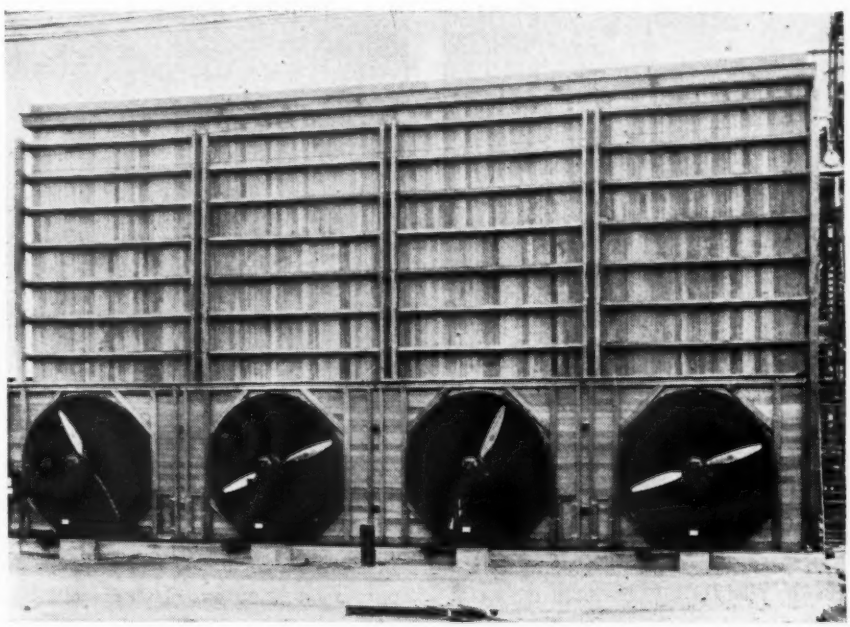
Only motor designs that have passed the rigid test of the Underwriters Laboratories have the right to display a label indicating that they are explosion proof. Conditions under which these tests are made duplicate as closely as possible the most severe in actual service. The motor is put in a test chamber, and both are filled with an explosive gas and air mixture. With the motor connected to a power source and running, the explosive mixture in it is ignited by a spark plug. To pass the test the motor must withstand the effects of the internal explosion and not permit flame or sparks to escape to ignite the air-gas mixture in the explosion chamber.

Motors of this design are available in a wide range of sizes from fractional horsepower to 600 hp. They vary electrically as to service, torque ratings and starting-current limits up to 2400 v ac. For operation where explosive-gas mixtures exist motors are available filled with inert gas under a slight positive pressure. This construction makes possible larger motors, especially synchronous machines, than are obtainable in explosion-proof designs.

Explosion-proof motors are accurately constructed with close clearances to insure safe operation in hazardous places. When repairing them make sure these close fits are maintained. Watch for signs of wear or defects and repair immediately if they endanger safe operation.

Illustrations, courtesy of General Electric Co. and Wagner Electric Corp.

Fig. 6, *below*—Four explosion-proof 20-hp 750-rpm 440-v induction motors, with oil-immersed explosion-proof magnetic switches for hazardous-gas Class I, Group D locations, drive fans in cooling tower



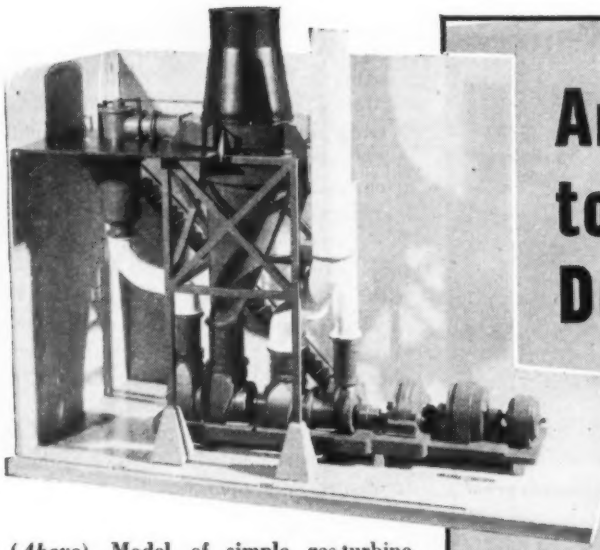
Engineers Awaken 'The Sleeping Woman'

▶ AFTER CENTURIES of undisturbed slumber, the famous Mexican volcanic mountain, Ixtaccithuatl, known internationally as "The Sleeping Woman," because of its resemblance to a reclining feminine figure, has been rudely awakened by scientists, electrical engineers and hundreds of workmen, according to a power engineer, recently returned to the United States from Mexico. The Sleeping Woman's eternal crest of snow is soon to provide hydroelectric power and irrigation for the four Mexican states of Vera Cruz, Morelos, Puebla and Hidalgo, he reports.

The six million dollar project involves construction of a network of canals along the sides of Mexico's third highest mountain, 17,338 ft high, to catch water from melting snows and atmospheric condensation. Snow level on The Sleeping Woman is at an elevation of 14,700 ft, and depth of the cap at the crest is several hundred feet. A steady fall of hail caused by atmospheric condensation above the snow-line will maintain the volume of water, and stabilize the output below.

Water collected in the canals will plunge downward, over man-made waterfalls, from 3000 to 5000 ft, and energy thus created will be transformed by giant turbines into electrical current.

This purpose served, ditches will carry it along to various sections of the central plateau where it will be utilized to irrigate vast areas of land in the four Mexican states.



(*Above*) Model of simple gas-turbine power unit clearly illustrates the size and arrangement of parts, compactness and absence of complex auxiliary equipment

American Contribution to Gas-Turbine Development—II

Temperature that materials can stand, how to burn coal, high-temperature oxidation—these are problems ahead of gas-turbine designers, says C C Jordan, Allis-Chalmers

1500-F Bolt Tests

Photos show results of long-time tests of stud assemblies in air, which yield a striking indication of metallurgical problems of gas-turbine operation at high temperatures

ARE GAS-TURBINE power-generating units commercially practicable? The answer involves another question of whether alloys are available to permit operation with gas temperatures of 1200 to 1500 F. For the past three years intensive metallurgical research has been carried out on this subject. From the mass of data accumulated, it now appears that the design engineer can go ahead knowing that a 1200-F gas temperature can be accommodated and that temperatures in excess of this may be practical as a natural consequence of actual operating experience on experimental units.

Details of the research program cannot be disclosed until after the war because of censorship restrictions but certain general statements can be made. Tests have shown conclusively that alloys are available with a satisfactory creep rate for 1200-F gas-temperature operation at stress levels that the designer can use for practical turbine proportions.

This particular problem is simplified by the fortunate characteristic of the gas-turbine cycle that high efficiency is more a function of temperature than pressure. Fortunately, high efficiency can be obtained with a gas pressure of approximately 60 psi. This permits the designer to keep stresses in the cylinder casing and in the bolting to a low level. Thus, so far as adequacy of material strength is concerned at elevated temperatures, substantial advancement has been made toward the achievement of a reliable construction.

Creep Problem

In the gas turbine, the designer will take many precautions to build up a high factor of safety with regard to creep. The full gas temperature is limited to the inlet piping and the first-stage nozzle chest, parts of inherently low stress. A substantial temperature drop is taken in the first-stage nozzles so that the cylinder casing will be subjected to a maximum temperature lower than the gas temperature. Cooling means can be used on the first-stage blade wheel so that its operating temperature is within limits where creep performance is well established. Blading clearances will be relatively large so that creep in the blades will not be the prime consideration.

Thus it appears that the designer is now in position to develop a gas turbine for operation at 1200-F gas temperature with confidence. As a matter of fact, research work has progressed to a point where testing is being done on bolting at metal temperatures of 1500 F, a temperature much in excess of actual bolt temperatures expected on turbines for any gas temperatures now being considered. Photos show the results of these tests on various bolt treatments and alloys.

A serious question to the potential operator of gas-turbine power units is, "What maintenance is to be expected?" Excluding the gas path and cooling requirements, the design of the gas turbine is essentially the same as that of a

steam turbine and no more maintenance problems are to be expected. This has been borne out on the Houdry gas-turbine-compressor units where gas temperatures are comparable to steam temperatures of modern steam-turbine plants. On these machines no more maintenance has been experienced than would be expected on steam turbines.

In one plant the total shutdown time for all purposes on eight Houdry units, installed between 1938 and 1943, has amounted to less than 5%, an excellent record when compared to the best of steam power plants.

Oxidation will probably be the determining factor for maintenance in the gas path. Extensive tests have indicated that oxidation is not serious at 1200-F metal temperature. Very few of the turbine parts operate at this temperature even when the initial gas temperature is as high as 1500 F.

Operating experience may indicate that certain of the turbine parts such as control valves, first-stage nozzles and possibly first-stage blading may have to be replaced at regular intervals. If the field experience on the first few experimental units indicates this, the design of commercial units will make replacement of such parts possible at reasonable cost. It is expected that oxidation will become more of a problem as the normal gas temperature is increased to 1500 F.

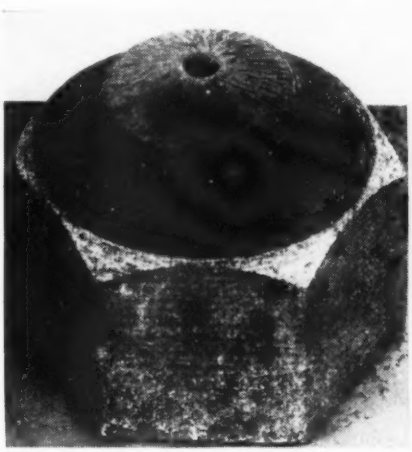
Gas-turbine efficiencies can be calculated for a high level—attractive for power-generation purposes. However, until the manufacturers build units for this service and accumulate a background of operating experience, the gas-turbine power unit must be considered as still in the experimental stage. Efficiency guarantees cannot be made on an experimental unit, only predictions of efficiency to be expected.

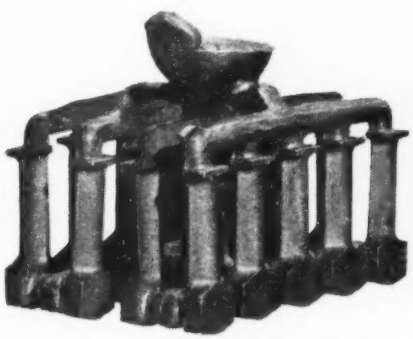
If efficiency guarantees cannot be made, what of efficiency expectancy? It appears that there are two possible fields for the use of the gas-turbine unit. The first is that of base-load power generation where increased cost of a high efficiency unit can be justified. Such a unit would use a gas temperature of 1200 F and possibly higher in the future.

Intercooling on the compressor, reheat on the turbine and regeneration would be employed to give an over-all thermal efficiency between 30 and 35% (11,400 to 9800 Btu per kwhr). The installation for this calculated efficiency would be more complicated than the Houdry units, on which we have accumulated experience, and presumably more difficult to operate. However, it should be less difficult to operate than the average modern steam plant because of the almost complete absence of water problems.

A second application offers more immediate promise—for peak-load operation. A gas turbine for this service probably would be designed for 1200-F gas temperature as a maximum and no doubt a simple cycle would be used to keep down initial cost. Sometimes a moderate amount of regeneration might be added. Such a unit is calculated to give an over-all thermal efficiency of approximately 20% (17,000 Btu per kw-hr).

With this unit, the station cost should be materially lower than that of the average modern steam station of similar size. Its simplicity will enable relatively fast starting time from cold condition. The absence of water, except to cool the lubricating oil, makes it possible to locate the station wherever necessary to minimize power-distribution costs. No doubt the next step in gas-turbine development will be the installation of a few of these peak knockers.





Single-gated casting of 20 supercharger buckets for high-temperature service. No machining of the port surfaces is required and only a slight grinding cut on front-and-back mating surfaces is needed to make the buckets usable

What of governing characteristics—a question that every good power plant operator may ask. The design of governing mechanism on a gas turbine is essentially the same as that on a steam turbine except that control is on fuel flow instead of steam flow. From a mechanical standpoint, the same reliability, the same sensitivity and the same regulation is to be expected. In one respect the gas turbine is easier to govern than the steam: After the unit is in operation, between 20 and 30% of maximum fuel flow is required at zero net power output.

The only concern in governing a gas-turbine unit is the heat stored in the combustion chamber and in the piping between the combustion chamber and the turbine inlet. This can be taken into account by proper design to minimize the volume of hot gas between burner and turbine inlet. For distances of 3 to 15 ft, which should cover maximum space requirements (and considering the amount of heat required in the gas

at full speed, no load) heat stored up between burner and turbine inlet is not sufficient to prevent attaining entirely satisfactory governing characteristics.

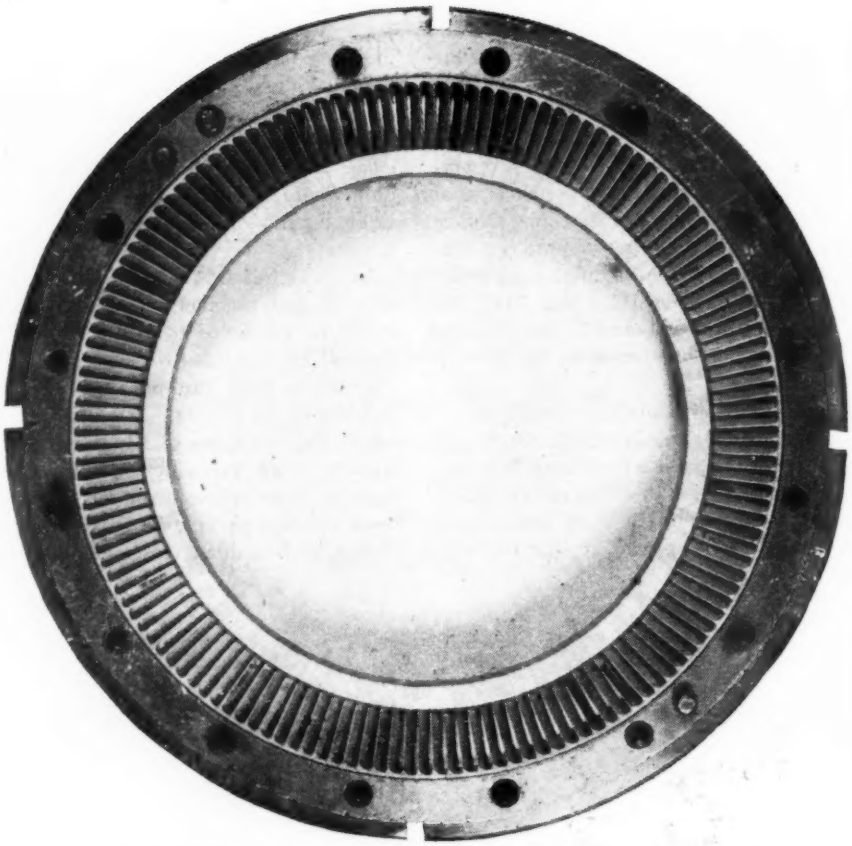
Burning of coal to power a continuous-combustion gas-turbine unit has been recognized as essential if this type of power unit is to have widest application. For over a year research work has been going ahead steadily on two phases of this problem (1) controlled burning of pulverized coal under the required air pressure, and (2) the effect on blade life of products of combustion.

While the work has not progressed far enough to give conclusive results, it does appear that the first phase of the problem can be accomplished. Much more work must be done on the second before conclusions are reached.

How About Cost?

What will a gas-turbine power unit cost? The cost of the first few experimental units will be high but some of this expense is already behind us. It is necessary to carry out an extensive research program. It is necessary to translate the results of this research work into practical designs. Finally, after the designs are complete, it is necessary to find out how to cast or forge and then machine the alloy steels that have been dictated by laboratory results. Finally, after the experimental units are built, there probably will be many design changes before a commercial unit is ready for the market.

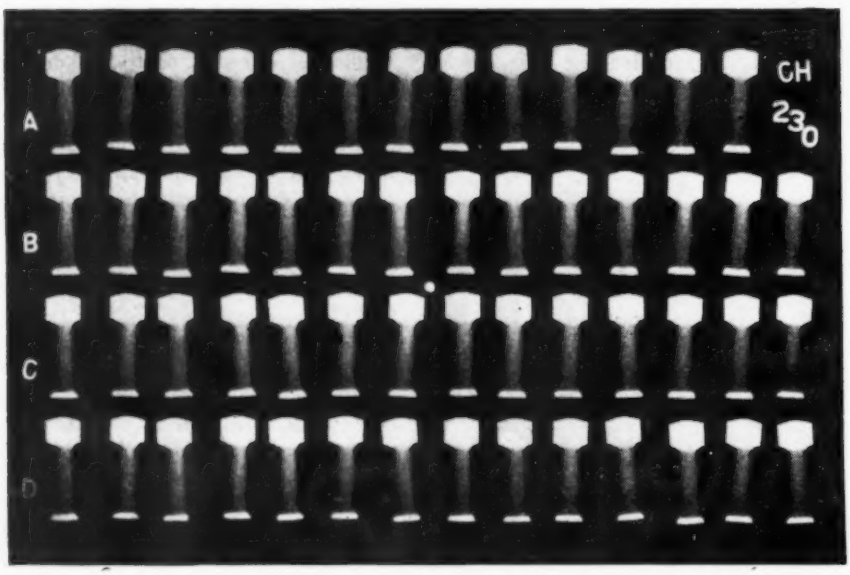
In view of these complications, any detailed prediction on gas-turbine power-unit cost is largely guesswork at this time. However, it is probable that after all of the preliminaries are over the ultimate cost of a power station using gas turbines will be materially lower than that of a similar size steam station.



Ring of supercharger buckets assembled in welding jig prior to attachment to the wheel disk. Precision casting can be extended to steam and gas-turbine parts

In conclusion, gas-turbine development in this country has arrived at a point where some experimental power generation units must be built to accumulate field experience necessary for a successful commercial unit. These experimental units will probably be in the size range of 2000 to 7500 kw. If units of 2000-3000 kw are built for peak knocking, much of the engineering already available on Houdry gas turbines could be used.

While there is nothing inherent in gas turbines that prevents building units larger than 7500 kw, the field experience will probably be obtained from moderate-sized machines. There is every reason to expect that the experimental units will be successful in pointing the way to a commercial unit that will have a definite place in the field of electric power generation.



Radiographic inspection film of supercharger buckets. Over 600,000 buckets are checked monthly by this process, which can be used also for gas-turbine blading

Robot Not Gas Turbine

German robot bombs launched against London are jet-propelled but do not employ rotating machinery similar to conventional gas turbines or superchargers. British Air Ministry information indicates that the propulsion tube takes in air through spring-guided shutters in front, fuel being spark-ignited intermittently. When explosion occurs, front shutters close and a powerful jet issues from the rear opening. Secondary vacuum wave opens shutters to admit a fresh air charge, and the cycle repeats.

Waterwalls Double Old Boilers' Output

Lloyd J Westin, Day & Zimmermann, Inc, shows how enlarged watercooled furnaces and lengthened stokers boosted capacity of three boilers in one plant by 90%, and of three units in another plant by more than 50%. Changes improved efficiency and reduced maintenance, supplying additional steam without building extensions or draft-system alterations

▶ HIGH OUTPUTS of modern steam generators result largely from highly watercooled furnaces, which operate at maximum heat absorption from radiant energy. In fact, some recent high-pressure units have practically no so-called boiler surface after the watercooled furnace; only superheater and economizer add heat by convection. Furnace gas first passes over the superheater, raising steam temperature to desired level. Gas next flows past economizer surface, heating feedwater to within a few degrees of saturated-steam temperature, or even generating steam sometimes. Finally, gas goes through an air-heater section, giving up a large part of the remaining heat to raise temperature of incoming combustion air. Such an air heater often yields 5 to 6 points additional efficiency; modern steam generators owe much of their high efficiency to air heaters.

In general, a square foot of tube surface (circumferential area) in the furnace and absorbing radiant energy, generates approximately 30 lb of steam per hr. This compares with 10 lb per hr evaporated in the boiler convection zone. Actual tests of a recently installed forced-circulation steam generator,* in which all latent heat was obtained from radiant surface in the furnace, showed an absorption rate of 65,000 Btu per sq ft (projected tube area). This is equivalent to evaporation of about 34 lb of 1800-psi steam per sq ft (circumferential area) per hr.

Although high-pressure units successfully dispense with evaporative convection surface, low-pressure units cannot go so far. The appreciably higher latent heat of evaporation met with at lower pressures cannot all be supplied by a completely watercooled furnace. Nevertheless, low-pressure units gain appreciable benefits from following high-pressure practice as far as possible.

Thus, today's design trend is almost entirely away from reliance on convection heating surface to installation of as much radiant-heat absorbing surface as possible. Twenty years ago designers believed that, to provide sufficient reflected heat from refractory surfaces,

* 1825-psi Topping Unit With Special Reference to the Forced-Circulation Boiler, *Combustion*, Dec. 1942

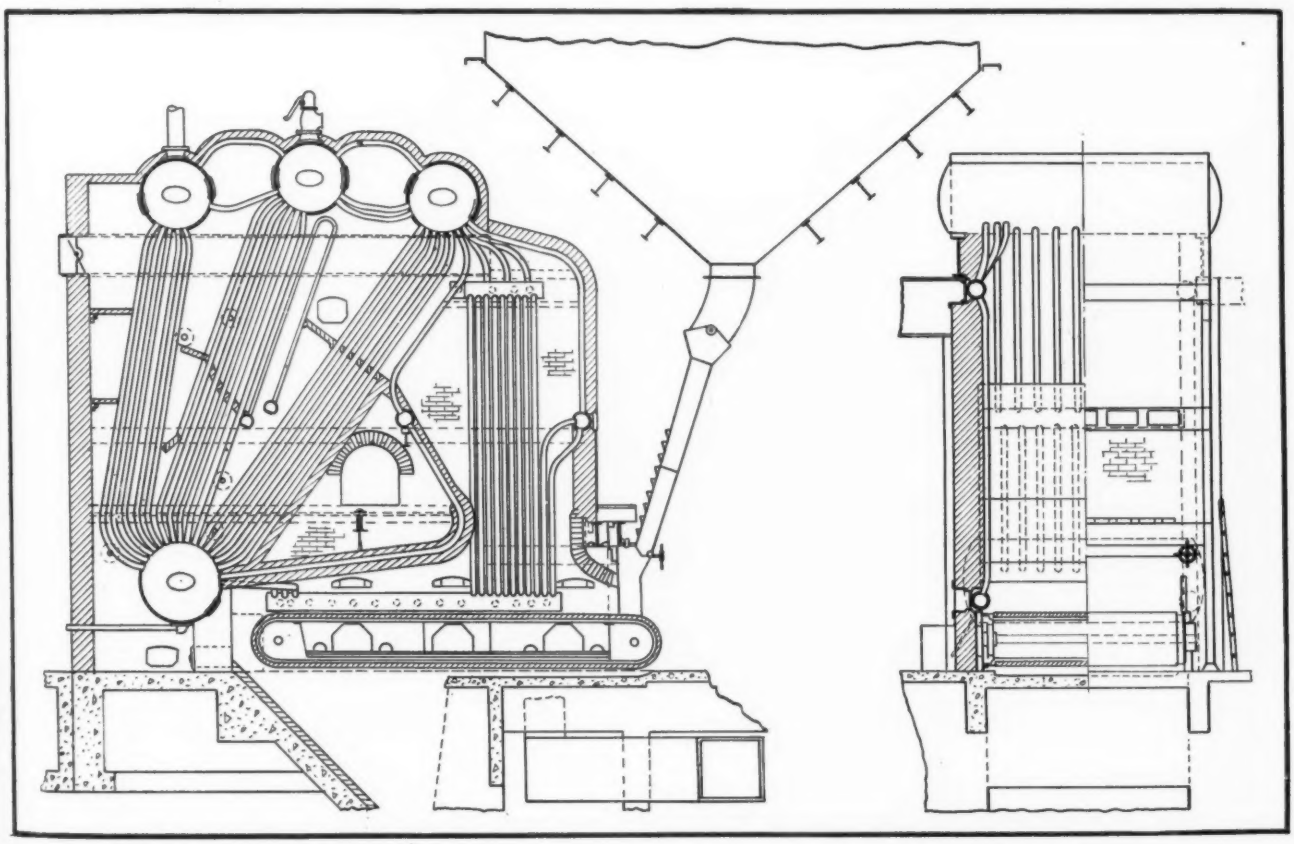


Fig. 1—Boilers at Rainey-Wood Coke Co after building out stokers 3 ft 6 in., extending furnace, installing side, front and roof waterfalls, and changing design of rear arch so that tubes connected in boiler circuit support and cool refractory tiles

boiler heat-absorbing surface should be placed as far from the furnace as possible. Fuel burned in large Dutch ovens and combustion gas passed from these furnaces to the boiler heating surface.

Recent experience proves this belief a fallacy: present-day furnaces incorporate a large proportion of *black surface*, that is, cold walls in the form of heat-absorbing watertubes. Fuels burn satisfactorily with these black furnace walls if sufficient turbulence effects proper mixture of fuel and air. Even blast-furnace gas having an extremely low heating value burns satisfactorily in waterwall furnaces, although for many years this was not thought possible. Maximum furnace capacity with pulverized coal requires complete watercooling to avoid slagging, and any question as to operation at low load may be met by good burner design and a sufficient number of burners.

Waterwalls Improve

It is apparent that furnace waterwalls for radiant-heat absorption constitute a major improvement over older boiler designs and that their addition to many existing units does not introduce combustion difficulties. This article illustrates the point by describing installations at Rainey-Wood Coke Co and Philadelphia Coke Co.

Rainey-Wood Coke Co boilerhouse contains three 5000-sq ft B&W Stirling boilers fired by Combustion Engineering Co's Coxe traveling-grate stokers. Philadelphia Coke Co plant comprises three 3120-sq ft B&W Stirling boilers, fired by Riley Stoker Co's Harrington traveling-grate stokers. Both plants burn coke breeze, a byproduct of the coke industry. At Rainey-Wood Coke Co, No. 3 buckwheat anthracite is fired when no coke breeze is available; Philadelphia Coke Co always has sufficient coke breeze to meet fuel requirements. Boiler steam, in both plants, supplies coke-production process requirements, steam-driven auxiliaries, and general uses.

Both managements faced a serious boiler problem—more steaming capacity had to be added as economically as possible. This could be done in either of two general ways: (1) Add new capacity, possibly another boiler unit in each plant. (2) Remodel all three boilers in each plant, to give additional output required. Because the first plan required building extensions, the second looked more attractive.

At first, it seemed that the only way to obtain added capacity involved lengthening the stokers to boost fuel-burning capacity and installing induced-draft fans to handle the higher draft loss from increase in gas flow through the boiler setting. In both cases, operation had been on natural draft.

The scheme finally worked out by the engineering staffs of Rainey-Wood Coke Co, I W Wolfgram, supt; Philadelphia Coke Co, A C Sedlacheck, supt; and Day and Zimmerman, Inc, Philadelphia, under the direction of John Phillips Badenhausen, added steaming capacity without altering the natural-draft condition, as outlined below. Fig. 1 and 2 show the completed installations.

At Rainey-Wood Coke Co, building out the Coxe stokers 3 ft 6 in. left the rear drive undisturbed; at Philadelphia Coke Co, the front drive of the Harrington stokers dictated extension at the back.

To avoid overloading boiler convection sections, the furnace itself was built out and waterwalls for absorbing radiant heat were installed. The two side waterwalls are fed by two lower headers located directly above the stoker sides. These watercooled headers limit clinker formation and practically eliminate expensive brick maintenance at this point. Tubes from the lower mud drum feed these headers, as in Fig. 1 and 2. Tubes extended to the upper front steam-and-water drum act as reliever connections from the upper headers.

A front and roof waterwall was also added directly above the front arch, as in Fig. 1. The feed to this front waterwall comes from the front ends of the lower side-waterwall headers. Changing arch construction made it possible for the stoker blast to blow unburned fuel from the back forward.

The rear arch design represents an unusual departure from regular practice. A series of tubes connected into the main boiler circuit support the refractory tile; heat absorption by the tubes cools the arch blocks and thus reduces arch maintenance. Rear-arch blocks hang on steel straps, the ends of which project into slots in the refractory. To conform to the upper tube surface, these straps are bent to obtain adequate cooling.

Watercooled Arches

This method of supporting and cooling arches proved sound; the first unit at Philadelphia Coke Co shows no noticeable deterioration, and units at Rainey-Wood Coke Co, which have operated five to six years, experienced only slight burning back of the refractory. Watercooling effect of the tubes seems to have stopped this burning now. Fig. 3 shows arch construction during erection.

In both plants, arch-supporting tubes form a portion of the added steam-generating surface. At Rainey-Wood Coke Co, lower ends of arch tubes connect into the mud drum and upper ends

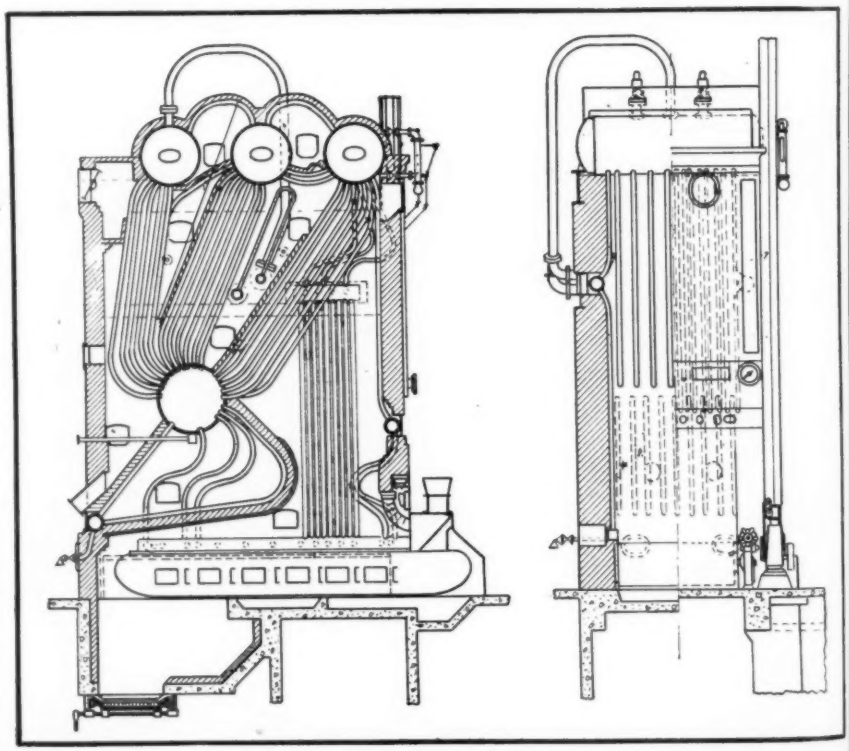


Fig. 2—At Philadelphia Coke Co similar changes were made, but front-drive stoker was extended to rear and details of waterwall arrangement and rear arch differ

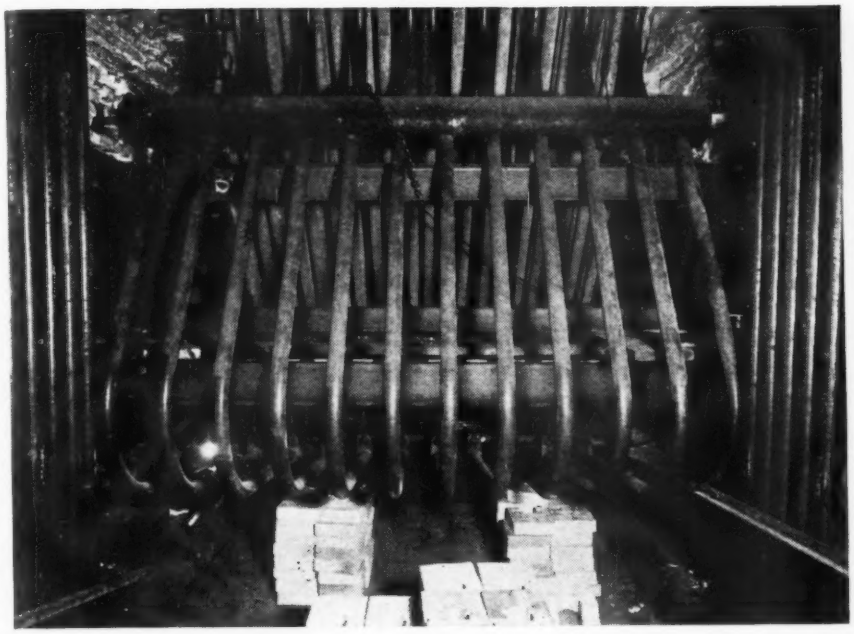


Fig. 3—View of rear arch at Rainey-Wood Coke Co shows side waterwalls, tubes for arch support and cooling, also relieving tubes running from header to front drum

terminate in a horizontal header across the furnace rear. Relief tubes from this header connect directly to the front steam-and-water drum. Spaced on 12-in. centers and set out from the first main row of boiler tubes, they act as a slag screen in the first path of gas leaving the furnace. Fig. 3 shows arch tubes, header and relief tubes. The screen cools slag below the plastic point before it enters the closely spaced boiler tubes, thus permitting high ratings.

Before the change was made at Rainey-Wood Coke Co, steam outlets, which were on the middle drums, were moved to the rear drums to take advantage of an inherent characteristic of the Stirling boiler, in which the water level stands lower in the rear drum than in either middle or front, particularly at high ratings. This means more steam space in the rear drum and thus dryer steam.

The change proved unnecessary at Philadelphia Coke Co because boilers as originally built had steam outlets on the rear drums. In both plants, steam from rear drums passes through a superheater section and out to the main header. Operating conditions are: Rainey-Wood Coke Co—175-psi g and 500 F; Philadelphia Coke Co, 235-psi g and 500 F.

Change on the first Rainey-Wood Coke Co unit was completed in April, 1937. Operation showed that better than 57,000 lb per hr could be obtained with ease and low maintenance, as against about 30,000 lb per hr with high maintenance before. Furthermore, even with increased flow, steam quality proved excellent, indicating elimination of a priming condition previously met at maximum ratings. Success of this first unit led to rebuilding the remaining two, which were put into service in February, 1938.

Although Philadelphia Coke Co faced a serious steam problem prior to the present emergency, it did not become acute until new steam-using equipment was added a few years ago. In the summer of 1942, the management decided to go ahead with the first unit, which they completed in the spring of 1943. Revamping of the other two units followed successful completion of the first; they went into service this spring.

Before remodeling the Philadelphia Coke Co boilers, each unit produced about 28,000 lb per hr. This represented maximum output that could be obtained without a considerable drop in drum pressure and serious arch trouble resulting in high maintenance and inefficient operation. Since rehabilitation, it proves possible to develop up to 43,000 lb per hr, with smooth operation and no drop in steam pressure.

Advantages Gained

The foregoing indicates that existing boiler plants can be improved when the units themselves are in good condition and higher steam pressure is not needed. In all these units, added steam output meant no sacrifice in efficiency over what had been obtained previously at considerably lower ratings. Actually, efficiency runs slightly better and saving is considerable in maintenance, which used to run excessively high under maximum load conditions.

Increased capacity comes from radiant-heat absorption in the furnace; the bare waterwall construction thus takes the burden from the boiler. Furnace cooling did not interfere with proper combustion of the coke breeze. Waterwall surfaces cooled the furnace gas before it entered the boiler section so that there was no overloading of the boiler passages to limit operation on natural draft. Even with added capacity, none of the rebuilt boilers required induced-draft fans.

This method of obtaining additional boiler capacity should appeal to engineers, executives and others associated with boiler-plant operation because it permits salvaging mechanically sound units of older design and bringing them up close to present-day standards. With a strong chance that highly competitive postwar conditions may put heavy emphasis on economy of construction as well as of operation, the ability to add capacity and improve efficiency without extensive building changes and other expensive work may prove of considerable interest.

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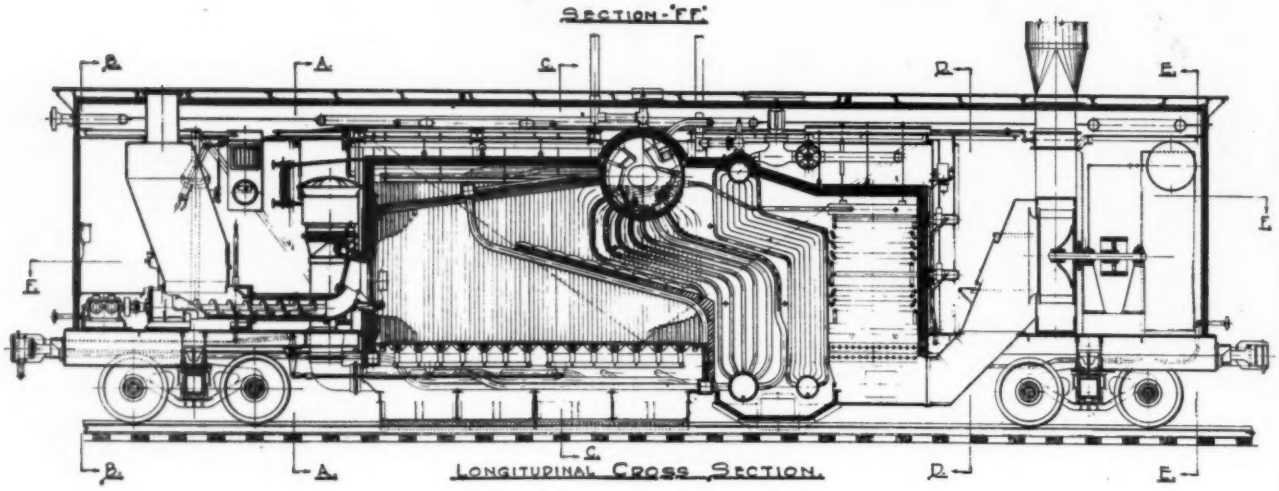
Mobile and Portable Power Featured in Pittsburgh ASME Meeting



Combustion Engineering Co provides steam-generating equipment in the two boiler cars of each 8-car 5000-kw Westinghouse "power train," of which ten are being built for foreign emergency service in war-torn areas. Each low-head boiler, fired by spreader stoker, can generate 40,000 lb steam per hr at 625 psi and 750 F when burning low-grade 7500-Btu coal

▶ FOLLOWING CLOSE on the heels of the armies of invasion, mobile and portable power plants, made in the U.S.A., will supply emergency power for military and essential civilian needs where battle destruction, or scorched earth operations, leaves a region literally "powerless." The novel and compact plants being built for this service were featured in a special session of the ASME semiannual meeting, Pittsburgh, Pa. (William Penn Hotel) June 19 to 22.

Two general types of emergency steam plants were described, the mobile *power trains*, 5000 kw and 1000 kw on wheels, and the 500-kw *portable plant*, packaged complete in 24 crates for convenient shipment and quick erection.

The power trains discussed are those now being assembled by Westinghouse on railway cars designed and built by General American Transportation Corp, East Chicago. Their main features were outlined by C M Laffoon, of Westinghouse. Otto DeLorenzi described the Combustion Engrg boilers installed in the 5000-kw trains, and F G Ely, the Babcock & Wilcox boilers of the 1000-kw trains.

A 3-page illustrated summary of Mr Laffoon's description appeared in July POWER. Reviewing here briefly, each of the ten 5000-kw trains now building or completed has eight 50-ft railway cars: two for steam generation, one for the main turbine, one for auxiliaries, one tank car for feedwater, two cars for condensers and one service car for the crew.

Besides the main 5000-kw 3000-rpm unit taking steam at 600 psi and 750 F, and generating at 6300/10,900 v, 50 cycle, 0.8 pf, the generator car contains a 75-kw diesel set for starting. Turbine exhausts at 2-psi gage to air-cooled condensers. Auxiliaries include turbine-driven feed pumps, evaporator, deaerator and air compressors.

Following are some facts regarding the Combustion Engrg steam-generating units, as described by Mr. DeLorenzi: The two boiler cars are identical, arranged with firing ends (one boiler per car) facing for convenient operation.

Steam for Power Trains

Each unit, with locomotive-type spreader stoker, can generate 40,000 lb of steam per hr, at 625 psi and 750 F, when burning low-grade bituminous coal of about 7500 Btu with an ash-softening point of 1800 F.

Furnace has a Hulson-type locomotive grate, fully water-cooled walls and a locomotive-type combustion arch. The extremely compact bent-tube boiler has a drainable superheater, a marine extended-surface economizer, and forced- and induced-draft fans.

Except for stacks (and a few other quickly removable attachments) the car, with its load of steam-generating equipment for 40,000 lb of steam per hr, is within the limiting clearances and weight of foreign railroads.

Full load furnace-heat release is 133,000 Btu per cu ft per hr (90 lb coal per sq ft of grate area per hr).

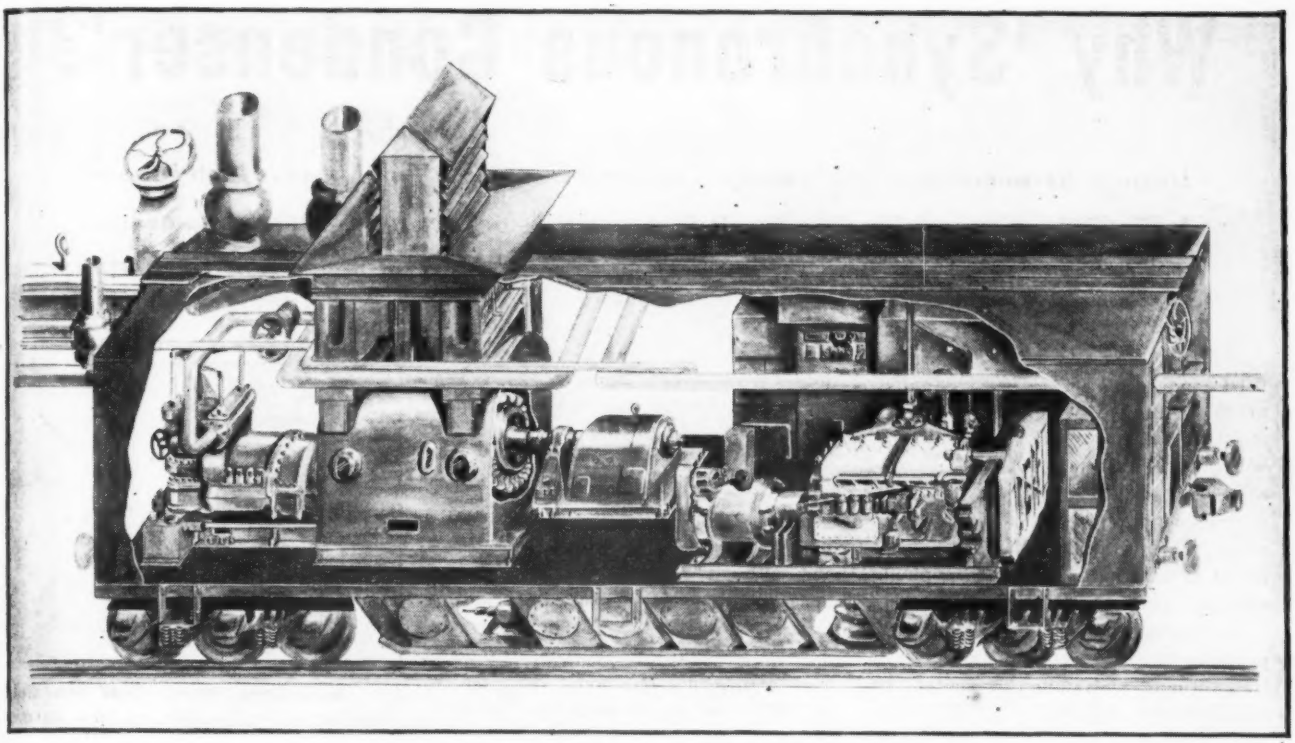
To save water, the stoker engines, stoker jets and soot blowers are compressed-air powered.

Babcock & Wilcox steam generators for the twenty-four 1000-kw power trains were described by F G Ely of that company. A single boiler car, with one boiler, serves the train. This 2-drum 16,000-lb-per-hr steam-generating unit, operating at 420 psi and 730 F, is very similar to self-contained units now widely used in stationary installations. It is completely assembled before being placed in the car.

The 1000-kw train, unlike the 5000-kw, has water-cooled condensers and cooling towers.

Aside from these power trains, America is now building 500-kw stationary steam plants. Each is complete in 24 portable packages, for semi-permanent installation wherever needed for essential service as the enemy is pushed out of occupied regions.

As described by L E F Wahrenburg, of Peter F Loftus, consulting engineers, Pittsburgh, the packaged plant can be erected complete in 36 hours, fits on a floor area 34x55 ft (in a special building or a railroad lobby, etc).



Artist's sketch of generator car of the 5000-kw power train. Main turbine at left takes steam at 600 psi, 750 F, and exhausts to air-cooled condensers (installed in two separate cars) at 2 psi. The generator (3000 rpm) delivers power at 6300/10,900 v, 50 cycles. At right is 75-kw diesel for auxiliary-starting power—in turn, started by a gasoline engine

The waterwalled longitudinal-drum boiler generates 12,000 lb per hr (including process steam) at 300 psi and 700 F, and is fired by spreader stoker with peat, lignite or low-grade coal. Also wood logs, 8x30 in., can be fired on a lower grate through an air seal. The unit has forced- and induced-draft fans.

The turbine-generator produces 500 kw, at 400 v, 50 cycle, 3 phase. Condensing water is cooled by spray tower.

Fitting Design to Fuel Facts

The danger of building steam power plants to burn merely the "usual" coal was stressed by E C Payne, consulting engineer, Consolidation Coal Co, in his paper "The Fuel Investigation Precedes Plant Design." For low-cost steam production over the next 20 or 30 years, he warned, plants designed today, and immediately after the war, must adapt size and type of fuel-handling and firing equipment to any coal that is likely to be economically available in a given district during that period. This, in turn, demands an elaborate survey of fuel production and transportation to estimate their probable future trends. Good design means buying equipment large enough and good enough to maintain needed steaming capacity when burning the worst coals likely to become competitively available.

Discussing Mr Payne's paper, E G Bailey, vice-president, Babcock & Wilcox Co, and well-known engineer said:

"In certain areas of this country, the logical fuel for the future is rather simple because the proximity of certain coal fields leaves little choice, and the far-seeing engineers are planning for the worst coal that can likely come from those areas, in order to have a reasonable factor of safety in operating their plants at expected capacity and efficiency regardless of normal or even abnormal variations in quality of fuel.

"Experiences of the past year will undoubtedly be accentuated during the next year in illustrating the importance of having coal-burning plants designed with some factor of safety as to character of coal, quality of coal, and ash characteristics.

"When coal-burning plants are located to receive their normal coal supply from the Appalachian fields, this problem is of much greater importance and, outside of a very few owners and engineers, the problem is not being given all the attention it deserves.

"There seems to be, at the present time, no recognized consultant who is in an authoritative position to advise on this subject. It again illustrates the overspecialization of our educational and industrial systems in that we are not properly training people to view engineering and economic problems from a broad perspective. This particular problem requires some knowledge of geology, mining conditions, basic mining costs, chemistry and combustion, railroad rate structures as they are and as they should be, together with statistical trends in production interpreted into the future.

"The power-plant builders of today and tomorrow, who are aware of the need of getting this information, may have to dig it out of half a dozen people, and coordinate it themselves, and they will some day thank those who helped them to get the best answer.

"Those who neglect to look that far ahead have only now to look around and see the results and worries of those purchasing agents and engineers who failed to give this question proper consideration when their plants were built, and for which they are trying to find suitable fuel."

Fuel Economics Neglected

In further discussion of this paper, J Tobey of the Coal Bureau, Upper Monongahela Valley Assn, said fuel economics is the most neglected branch of power engineering and one of the most important. Many plant designs are pathetic. The main fault is undersized equipment resulting from price competition. He cited a case where a 5-year-old plant could burn nothing but a premium metallurgical coal.

In his well-illustrated paper, "Coal

(Continued on page 202)

Why 'Synchronous Condenser'?

Despite its name the synchronous condenser is not a condenser. Instead, says L W Riggs, General Electric Co, it is a positive or negative alternating-current exciter — a machine that supplies or consumes alternating-current excitation

▶ EXCITING CURRENT, also called magnetizing or wattless current, always exists in ac power systems, sometimes with good, but quite often with bad effects because electrical machinery requires current to excite its electromagnets. This current may be either direct or alternating depending on design and purpose of the machine.

Alternating current flowing through properly placed and connected coils in transformers and induction motors establishes the magnetic flux necessary for operation. This current flows in the same windings as the power current and may be considered as exciting current drawn from the power system, which in turn must get it from some source that has or can be made to supply a surplus.

One convenient source is synchronous machinery, such as generators, motors and synchronous condensers. These machines, unlike the transformer or induction motor, have two sources of excitation: (1) direct current and (2) alternating current. Either source can be used alone or in combination, or an excess furnished by one source can have its effect bucked down to normal by the other. Motors and generators that furnish reliable power have a practical limit to this juggling of excitation.

However, in a synchronous condenser without shaft load, this limitation does not exist; its excitation may come from the system (maximum lagging kva in a motor or condenser, but leading kva in a generator) or its dc excitation may be gradually increased to produce a corresponding automatic decrease in ac excitation input until the latter is practically zero (bottom of V-curve). Continued increase in dc field strength (an excess) causes ac excitation, which has been coming in, to reverse itself and go out on the line to help excite some other piece of apparatus. (We call this *leading kva* in a motor or condenser, but *lagging kva* in a generator.)

Using the concept of over and under excitation we no longer have to remember anything about leading or lagging or motor or generator operation. It is merely necessary to remember that over-excitation (excess dc) pushes ac excitation out onto the line, and that under-excitation (deficiency of dc) drains it off the connected system.

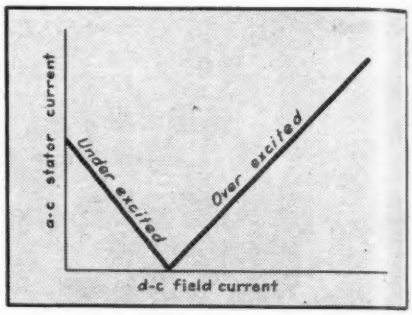


Fig. 2—V-curve shows how dc field strength controls stator exciting current

Synchronous condensers are sometimes installed for power-factor correction, at other times for voltage regulation, but regardless of which purpose is served, supplying or absorbing ac exciting current accomplishes it. This current may come from generators in a powerhouse, but it is not generally desirable to use up generator capacity, or to carry exciting current (wattless current) long distances over a transmission line when it can be furnished locally by a synchronous condenser.

This same job can be done by capacitors, or more completely by a combination of capacitors and reactors. Several advantages which the synchronous condenser has over the capacitor-reactor combination are: (1) Ac excitation can be released smoothly instead of in steps. (2) Flywheel effect (WR^2) is useful to the system. (3) It has inherent ability to release, up to a certain extent, exciting kva when the line voltage dips and thus helps maintain voltage. (4) Considerable shaft load can be carried without appreciable sacrifice in its ability to furnish ac excitation. For instance, shaft loads of 10 to 50% of rating still permit using 99 to 86% respectively of its rating for over-excitation purposes.

As shaft load increases, the machine gradually becomes a synchronous motor. But when used as a motor, follow manufacturer's recommendations, as it may not develop suitable torque or its mechanical parts may not be strong enough for heavy power load.

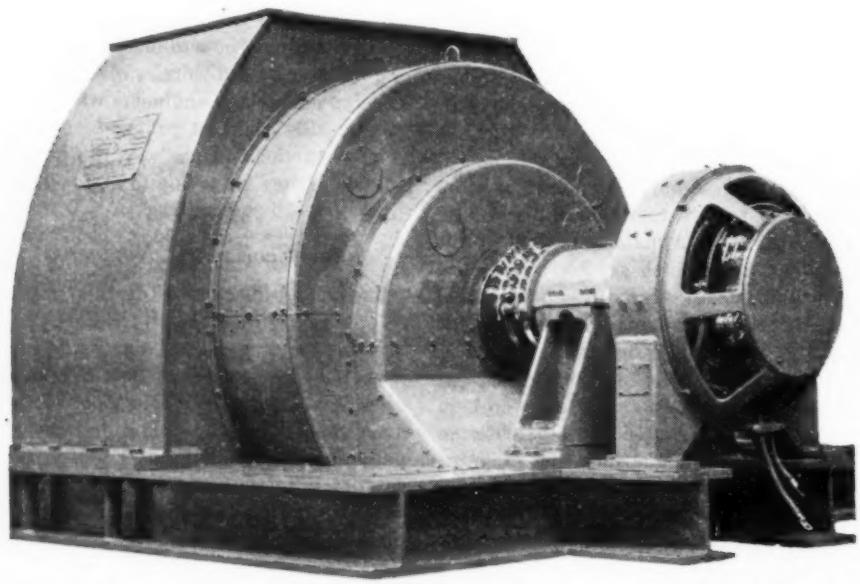


Fig. 1—The synchronous condenser corrects power factor or regulates voltage by drawing alternating-current excitation from or supplying it to the system

Step-Up Ice Production During Off-Peak Hours

When other processes take refrigeration needed in the ice tank, you can make up lost time by operating at reduced temperatures after the peak. H A Boysen gives a practical guide that engineers can follow in regulating ice-tank brine temperatures *

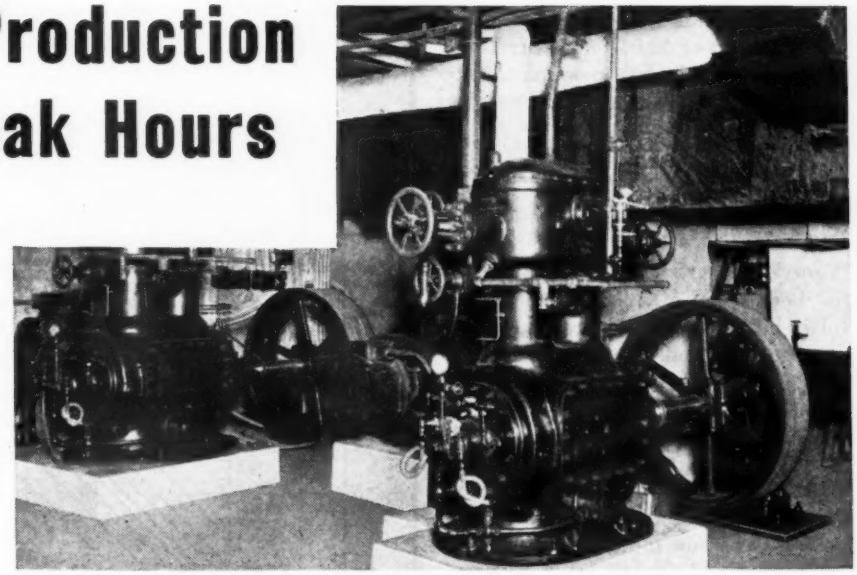


Fig. 1—When peak load is greater than installed refrigerating capacity, schedule compressor off-peak operation so that lost freezing time can be made up

▶ DURING HEAVY LOAD PERIODS—when process cooling is superimposed on plant load—ice-tank brine temperature may increase to 20 or 22 F. Then the operating engineer must catch up on ice production by subcooling the brine during the remaining periods of the day. To do this as economically as possible, he must have some way of constantly checking freezing progress.

While not so essential when constant temperature and only slightly varying loads prevail, it is, nevertheless, important in plants with no storage where the amount of ice pulled is constantly changing. The latter condition frequently taxes plant capacity at any brine temperature, so it is important that freezing be distributed over the shifts as evenly as possible. Ice manufacture in these plants may be regarded as a sideline to be spread over periods during which little or no other regular process cooling takes place. Here is how the system works:

Freezing time of ice cakes may be calculated from

$$\frac{7 \times t^2}{32 - t_b}$$

t_b = brine temperature, deg F
t = average ice thickness, inches

obtained from any refrigeration textbook. Table I gives the time for 300-lb cakes.

As a reference, assume a freezing time of 47.05 hr per can at 14-F brine temperature, and assign to it a factor of one (1). Any temperature above 14 F reduces ice output and is assigned to a factor larger than one—proportional to the time required in excess of 47.05 hr; similarly any temperature below 14 F has a factor less than one. Taking hourly temperature readings requires adding only eight factors each working shift to find out how ice making is progressing.

Total the Factors

Factors must add up to 24 for the total 24 hr to assure full-tank-capacity output. If their sum is less, too much refrigeration has been applied needlessly; if it is more, the cakes will not be completely frozen. For instance: Factors of the 4-12 shift add up to 9.28 for 8 hr, leaving 24—9.28=14.72 for the remaining 16 hr of the day or an average of

$$\frac{14.72}{16}$$

=0.92, corresponding to a brine temperature of about 12 F. This gives the next man a definite guide to make up for deficiency in refrigeration during the previous shift, Table 2.

Table I
Freezing Time For Ice

Brine temp F	*Freezing time hr*	*Freezing-time factor*
5	31.37	0.67
6	32.57	0.69
7	33.88	0.72
8	35.29	0.75
9	36.82	0.78
10	38.50	0.82
11	40.33	0.85
12	42.35	0.90
13	44.57	0.95
14	47.05	1.00
15	49.82	1.06
16	52.93	1.13
17	56.46	1.20
18	60.50	1.29
19	65.15	1.39
20	70.58	1.50
21	77.00	1.64
22	84.70	1.80
23	94.11	2.00
24	105.88	2.25

Table II
Hourly Freezing Factors

Time	*Brine temp F*	*Factor*	
4 pm	8	0.75	
5 "	10	0.82	
6 "	14	1.00	
7 "	16	1.13	
8 "	18	1.29	
9 "	20	1.50	
10 "	20	1.50	
11 "	18	1.29	9.28
12mdn	18	1.29	
1 am	18	1.29	
2 "	17	1.20	
3 "	16	1.13	
4 "	16	1.13	
5 "	14	1.00	
6 "	12	0.90	
7 "	10	0.82	8.76
			18.04
8 am	10	0.82	
9 "	10	0.82	
10 "	10	0.82	
11 "	10	0.82	
12 N	9	0.78	
1 pm	9	0.78	
2 "	9	0.78	
3 "	9	0.78	6.40
			24.44

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Factors of the next shift total 8.76, giving a total of 18.04 for 16 hr. There are now only 8 hr left in which to take care of $24-18.04=5.96$, averaging $\frac{5.96}{}=0.74$ per hr. This requires a brine temperature of 7 to 8 F for the remaining 8 hr to produce a full tank of ice in 24 hr.

Service departments usually have little knowledge of the difficulties involved in producing the ice; they simply demand an output corresponding to their needs. The operating engineer must answer for half-frozen cakes.

Loading the Ice Tank

Let's see how we put extra load on the ice tank by lowering the brine temperature and how the initial water temperature affects the amount of refrigeration required. Conventionally the refrigeration required is determined as follows: Total heat to be removed is made up of (1) cooling the water to 32 F (2) heat of fusion—144 Btu (3) cooling the ice to brine temperature (4) heat losses from ice tank and cans, usually taken as 20% of the theoretical requirements. Suppose we have 60-F water and 12-F brine in the system:

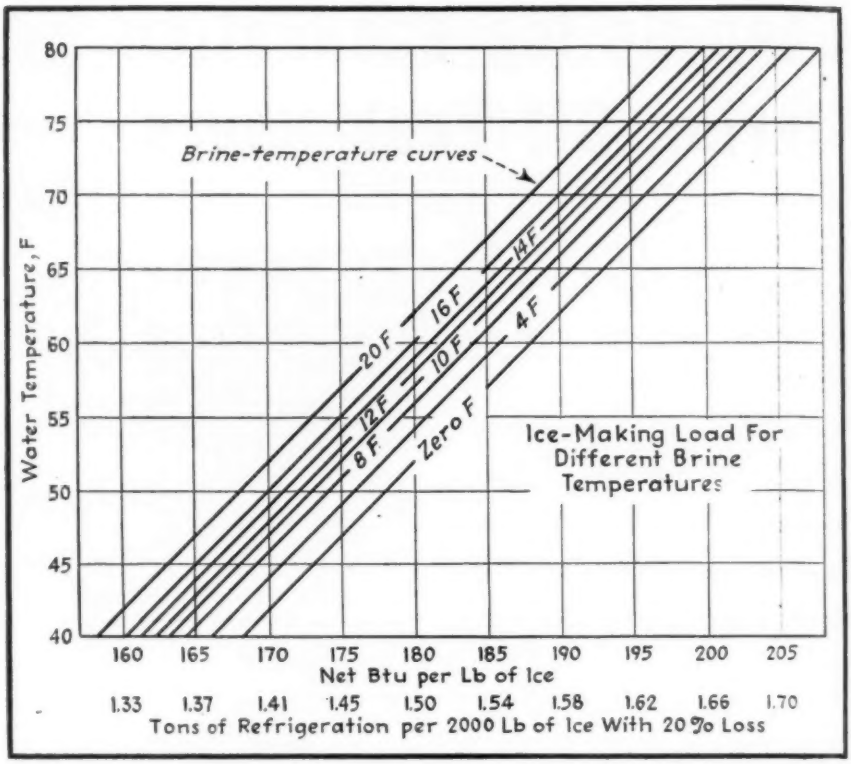


Fig. 2—Curves show how extra load is put on the ice tank by lowering the brine temperature, and how initial water temperature controls the refrigeration needed

Btu	
28	(60-32) cooling the water to 32 F
144	latent heat of fusion
10	[0.5×(32-12)] cooling ice to brine temp
182	Total net heat removed per lb of ice
36.4	20% for losses
218.4	Total heat to be removed per lb of ice

$\frac{218.4\times 2000}{288{,}000}=1.517$ tons of refrigeration per ton of ice manufactured.

To eliminate these detailed calculations I made the graph, Fig. 2, showing the ice-making load for incoming water from 40 to 75 F and brines from zero to 20 F. An easily made calculator, Fig. 3, reveals at a glance the ice-tank loads at these various temperature combinations. Use it by pointing the arrow at the selected brine temperature and read the required net Btu and total tons refrigeration (including 20% for losses) per ton of ice (2000 lb) directly opposite any of 36 water temperatures.

A 500-can (each can 300 lb) ice tank, operated with 14-F brine to freeze ice from 72-F water and from which 250 cans are pulled every 24 hr constitutes a load over a 24-hr period of:

$$\frac{250\times 300\times 1.608\ \text{(from calculator)}}{2000}=60$$

tons of refrigeration

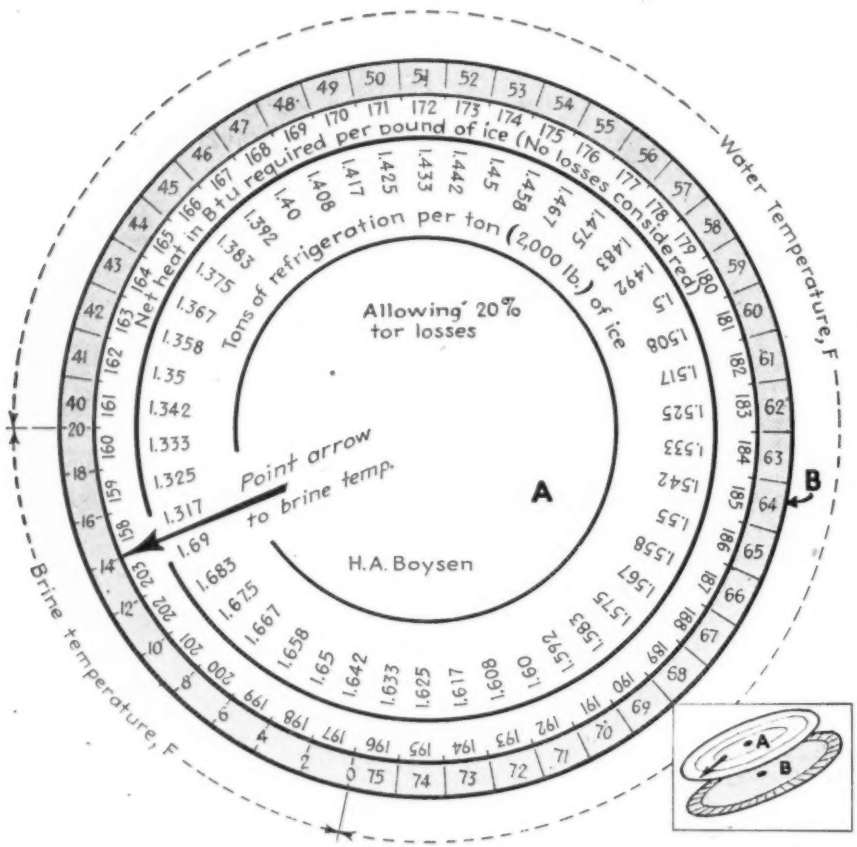


Fig. 3—Mount the inner and outer chart circles on heavy cardboard. Fasten them together with *A* on top so that the arrow points to temperatures on outer circle. Set arrow at brine temperature, read refrigeration opposite water temperature

This method easily establishes how much refrigeration is required for the load, but the engineer needs to know just how much refrigeration is actually applied to the ice tank during any period and at any brine temperature other than the one initially used to establish the load.

By using the calculator we determined a load of 60 tons and only know that by applying less than this ice production lags. Under the conditions stated it lags nearly in indirect proportion to freezing-time factors, and not brine temperature. However, the brine temperature is a direct guide to these factors which we previously established.

For instance, if the brine rises to 20 F, for which the freezing-time factor is 1.5, then the amount of refrigeration actually applied would be $\frac{60}{1.5} = 40$ tons, or for 17-F brine with a factor of 1.20, it would require $\frac{60}{1.2}$ or 50 tons.

To predetermine at what temperature the tank may be held when extra tonnage is required for other purposes, the foregoing equation is simply reversed. For instance, if other processes need 15 tons of refrigeration, only 45 instead of 60 tons could be applied to the tank. Then $\frac{60}{45}$ establishes a factor of 1.33, indicating that the tank can be held at between 18 and 19 F. Thus being prepared, the engineer need not shut the tank off entirely. Cutting it off permits the tank temperature to rise to perhaps 23 or 24 F, and eventually there would not be enough capacity in the entire 24-hr operating cycle to make up for lost time.

Seasonal Harvest

If the plant contains only one ice tank, and if only 100 instead of 250 cakes are pulled at the beginning or end of a season, the tank can, of course, be put on a 3- or 4-day schedule at correspondingly higher brine temperatures: about 20 F for 72 hr or 23 F for 96 hr. Some actual reduction in loss from these holdover frozen cakes can be realized by doing this. Obviously the ice tank freezing load is less when only part of the cakes are pulled, but heat loss from heldover cakes must be added to the freezing load.

For example, if only 100 cakes are pulled, 150 remain in the tank and 20% of the refrigeration put into them is lost:

$$\frac{60 \text{ tons}}{250 \text{ cakes}} \times \frac{1}{5} \times 150 \text{ cakes} = 7.2 \text{ tons losses held over}$$

The 100 cans pulled constitute a load of:

$$\frac{100 \times 300 \text{ lb} \times 1.608}{2000} = \text{nearly } 24.1 \text{ tons}$$

Or the total ice-tank load will be: $24.1 + 7.2 = 31.3$ tons

On the other hand, if the tank is persistently overdrawn, buying extra ice is obviously more economical than trying to produce it at correspondingly lower temperatures.

If brine circulates at a known rate through a shell-and-tube cooler, or any other cooling device that permits taking inlet and outlet temperatures, the amount of refrigeration applied can be ascertained by applying the gal/deg values (heat-values) of the brine (listed for a variety of temperatures and densities in Table 3). Second column contains the weight per gal of brine obtained by multiplying the corresponding specific gravity by 8.3.

To change the temperature of one gal of brine 1 F (column 4) requires a heat corresponding to the weight per gal times the specific heat of the brine listed for various specific gravities and temperatures.

The gal, per deg difference in temperature, per ton, per min (gal/deg/ton/min), required to absorb 200 Btu/min (column 5) are found by dividing $\frac{200}{\text{Btu per gal}}$ Fundamentally, of course, the product of brine gpm times its temperature rise equals the product of tons of refrigeration per min times gal/deg/ton/min (example in Table 3).

Table III—Calcium Brine Heat at Various Temperatures and Densities

Specific gravity	Weight per gal. (lb)	−20 F			−10 F			Zero F			+5 F			+10 F		
		Specific heat	Btu/gal	Gal/deg/ton/min	Specific heat	Btu/gal	Gal/deg/ton/min	Specific heat	Btu/gal	Gal/deg/ton/min	Specific heat	Btu/gal	Gal/deg/ton/min	Specific heat	Btu/gal	Gal/deg/ton/min
1150	9.55	....	....	.....	....	....	.....	....	....	.....	.....	....	.....	.757	7.25	27.59
1160	9.63	....	....	.....	....	....	.....	....	....	.....	.....	....	.....	.748	7.20	27.78
1170	9.71	....	....	.....	....	....	.....	....	....	.....	.....	....	.....	.737	7.16	27.93
1180	9.79	....	....	.....	....	....	.....	....	....	.....	.....	....	.....	.727	7.12	28.09
1190	9.88	....	....	.....	....	....	.....	.712	7.03	28.45	.7145	7.06	28.33	.717	7.08	28.25
1200	9.96	....	....	.....	....	....	.....	.703	7.00	28.57	.705	7.02	28.49	.707	7.04	28.41
1210	10.04	....	....	.....	....	....	.....	.694	6.97	28.69	.6965	6.99	28.61	.699	7.02	28.49
1220	10.13	....	....	.....	.681	6.90	28.99	.686	6.95	28.78	.6885	6.97	28.69	.691	7.00	28.57
1230	10.21	....	....	.....	.674	6.88	29.07	.679	6.93	28.86	.681	6.95	28.78	.683	6.97	28.69
1240	10.29	.663	6.82	29.32	.667	6.86	29.15	.672	6.91	28.94	.674	6.94	28.82	.676	6.96	28.74
1250	10.38	.657	6.82	29.32	.661	6.86	29.15	.665	6.90	28.99	.667	6.92	28.90	.669	6.94	28.82
1260	10.46	.651	6.81	29.37	.655	6.85	29.20	.659	6.89	29.03	.661	6.91	28.94	.6636	6.94	28.82
1270	10.54	.646	6.81	29.37	.646	6.81	29.37	.653	6.88	29.07	.655	6.90	28.99	.657	6.92	28.90
1280	10.62	.645	6.85	29.20	.645	6.85	29.20	.647	6.87	29.11	.6475	6.88	29.07	.650	6.90	28.99
		12 F			14 F			16 F			18 F			20 F		
1150	9.55	.760	7.26	27.55	.761	7.27	27.51	.762	7.28	27.47	.763	7.29	27.43	.764	7.30	27.40
1160	9.63	.749	7.21	27.74	.750	7.22	27.70	.751	7.23	27.66	.752	7.24	27.62	.753	7.25	27.59
1170	9.71	.738	7.17	27.89	.739	7.18	27.86	.740	7.19	27.82	.741	7.20	27.78	.742	7.205	27.76
1180	9.79	.728	7.13	28.05	.729	7.14	28.01	.730	7.15	27.97	.731	7.16	27.93	.732	7.17	27.89
1190	9.88	.718	7.09	28.21	.719	7.10	28.17	.720	7.11	28.13	.721	7.12	28.09	.722	7.13	28.05
1200	9.96	.708	7.05	28.37	.709	7.06	28.33	.710	7.07	28.29	.711	7.08	28.25	.712	7.09	28.21
1210	10.04	.700	7.03	28.45	.701	7.04	28.41	.702	7.05	28.37	.703	7.06	28.33	.704	7.07	28.29
1220	10.13	.692	7.01	28.53	.693	7.02	28.49	.694	7.03	28.45	.695	7.04	28.41	.696	7.05	28.37
1230	10.21	.684	6.98	28.64	.685	6.99	28.61	.686	7.00	28.57	.687	7.01	28.53	.688	7.02	28.49
1240	10.29	.677	6.97	28.69	.678	6.98	28.65	.679	6.99	28.61	.680	7.00	28.57	.681	7.01	28.53
1250	10.38	.670	6.95	28.78	.671	6.96	28.74	.672	6.98	28.65	.673	6.99	28.61	.674	7.00	28.57
1260	10.46	.6638	6.94	28.82	.6646	6.95	28.78	.6654	6.96	28.74	.6662	6.97	28.69	.667	6.98	28.65
1270	10.54	.6576	6.93	28.86	.6582	6.937	28.83	.6588	6.94	28.82	.6594	6.95	28.78	.660	6.96	28.74
1280	10.62	.6508	6.91	28.94	.6515	6.92	28.90	.6524	6.93	28.86	.6532	6.94	28.82	.654	6.95	28.78

Example: Brine at 1.200 specific gravity and 12 F. Temperature difference between inlet and outlet: 6 F. Quantity circulated: 500 gpm. $\frac{500 \times 6}{28.37} = 106$ tons

THE OLD CHIEF

PROBLEM CHILDREN

He solemnly recited "Man was made to mourn" to a brother Scot

Sure, the Old Chief's hard-fisted dirty-faced children were problems, but he knew the right answers without benefit of psychology. Another story by William Doran, chief engineer of the Essex County Sanatorium, Windsor, Ontario, Canada

A GIFTED LADY PSYCHOLOGIST once came to the Old Chief's town and during a fashionable lecture said, "There are no problem children, but there are many problem parents." This august statement won for the lady a lot of newspaper publicity and the plaudits of most of the old maids and old bachelors in town.

Because I had always considered the gang at the old plant as a big family, I could not fail to think of the many hard-fisted dirty-faced grownup children, who had been problems to the Old Chief. One type came from the group he called "human crows," probably from their habit of picking up and taking to their nests anything in sight.

They whisked small tools away while your back was turned. If we took down outmoded lighting fixtures, they disappeared before they could be placed in the salvage room. One thrifty motorist even carried home a small bottle of oil every night for his Model-T Ford.

Alarming reports drifted in regarding cash stolen from the pockets of the men's clothing when it hung in the dressing room. This was going beyond a joke and we determined to find the culprit. The room was in a passageway to the shower where it was thought safe because of the numbers passing to and fro all day. However, with the aid and connivance of the police department we set up a trap. Near the entrance we placed a bench and gave a boy a number of castings to file to size there. In the dressing room, in one man's pants pockets we placed a number of specially marked coins. After every lone visitor came out the boy checked the coins, and the result was that *we caught our man within a very few hours.*

All of the men guilty of theft had one thing in common—they had no economic reason to steal. All earned a good wage and were fairly well off in material matters. I guess they just got a kick out of stealing things they did not need, the same as crows do.

Then there was the troublemaker who had a *fixation* that everyone was against him and trying to have him fired. Such a bird can often make a whole shop *moody* unless he is straightened out. The Old Chief's cure was to wish the pest on some other department with his blessing.

Our Bulbous Friend

By far the majority of our problem children were accompanied by our old bulbous friend, John Barleycorn. Our payday pilgrims invariably had to lay off work after every payday with (ahem) toothache, indigestion or a bad cough. The *gulpers,* or secret drinkers, swore they never touched a drop, but reeked of it all the time. It was just the same as being addicted to a drug.

We also had *time-bomb drinkers,* particularly Dick, the machinist. He was steady as a rock for six months, then—usually when the Old Chief was away—he broke out on a royal binge. In this happy state he hated to be alone, and often had half the shop in the same condition.

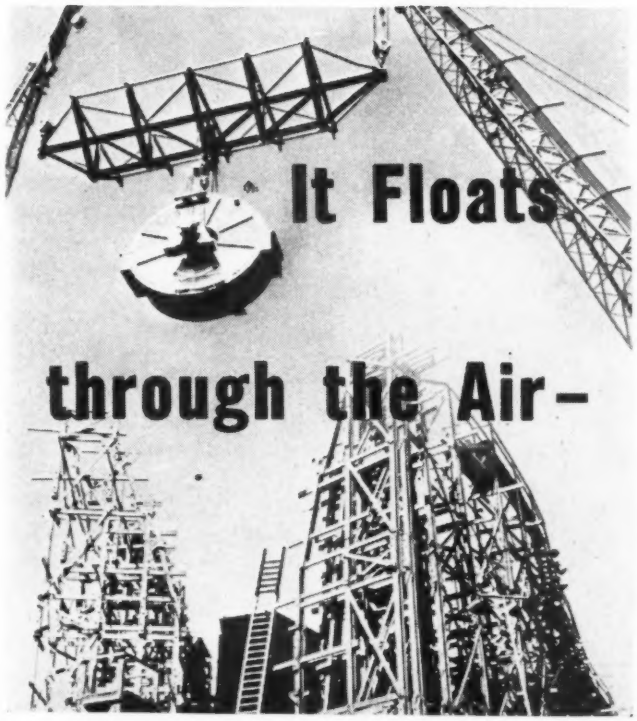
One-Fault Richard

Dick's final splurge was a honey. The Old Chief and I returned from a business trip earlier than the men expected. At the door were two apprentices as sick as dogs. The tool-crib man was solemnly reciting Robert Burns' poem, "Man was made to mourn," to a brother Scot, who was silently weeping and shaking his head. In the engine room the oiler was tiptoeing around as though afraid of waking someone, while his expression had all the unction and blandness of a saint. In the pump room an engineer carefully studied the action of a reciprocating pump. To concentrate on the subject, he was sitting on the floor with his eyes closed and his back braced against a post.

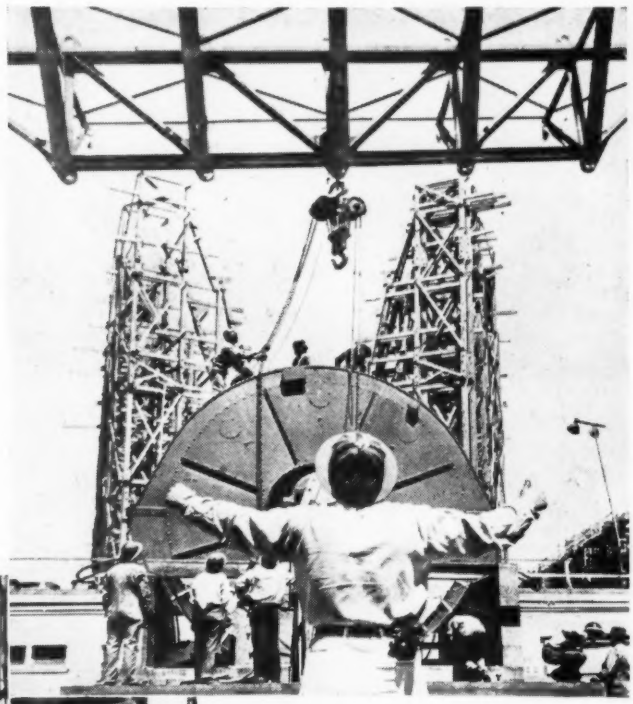
Richard himself was in the shipping room, explaining to all and sundry that "a little drink never did any one any harm." That may have been quite true of a little drink, but it was not true of the Old Chief, who did him quite a lot of harm by throwing him out of the old plant.

It Floats through the Air—

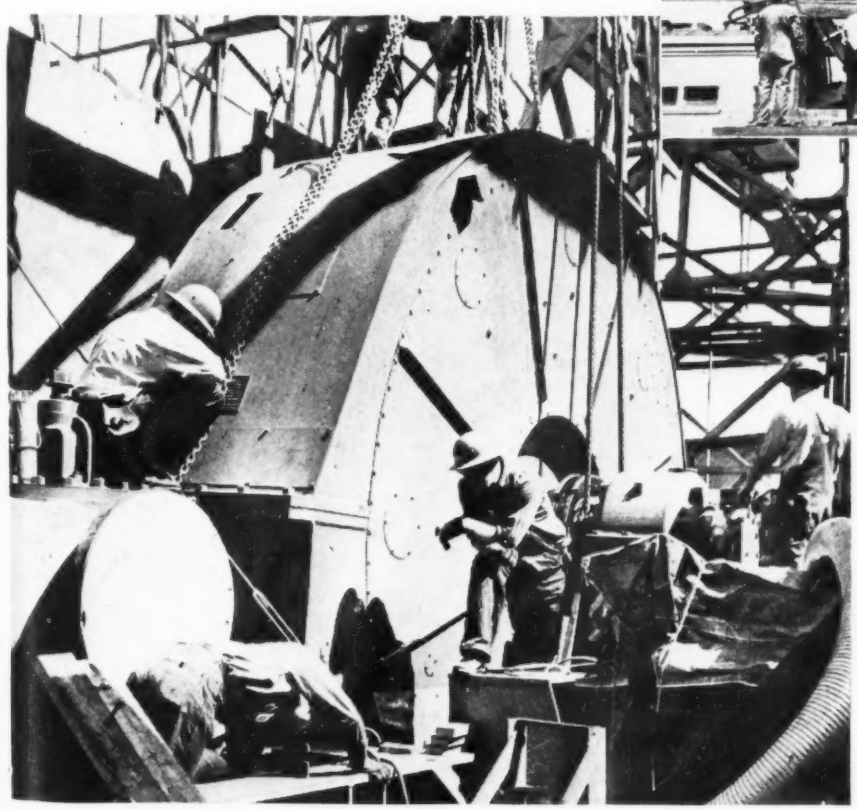
with the greatest of ease—"it" being a 10,000-hp propulsion motor to be set down with precision in the hull for one of our merchant marine's new high-speed tankers



Above: Two whirly cranes lift spreader and suspended motor more than 100 ft in the air on its way to the waiting hull



Right: A safe journey begins on the ground—workmen carefully adjust chain slings to divide load of motor between rotor and stator frame before the giant leaves the truck



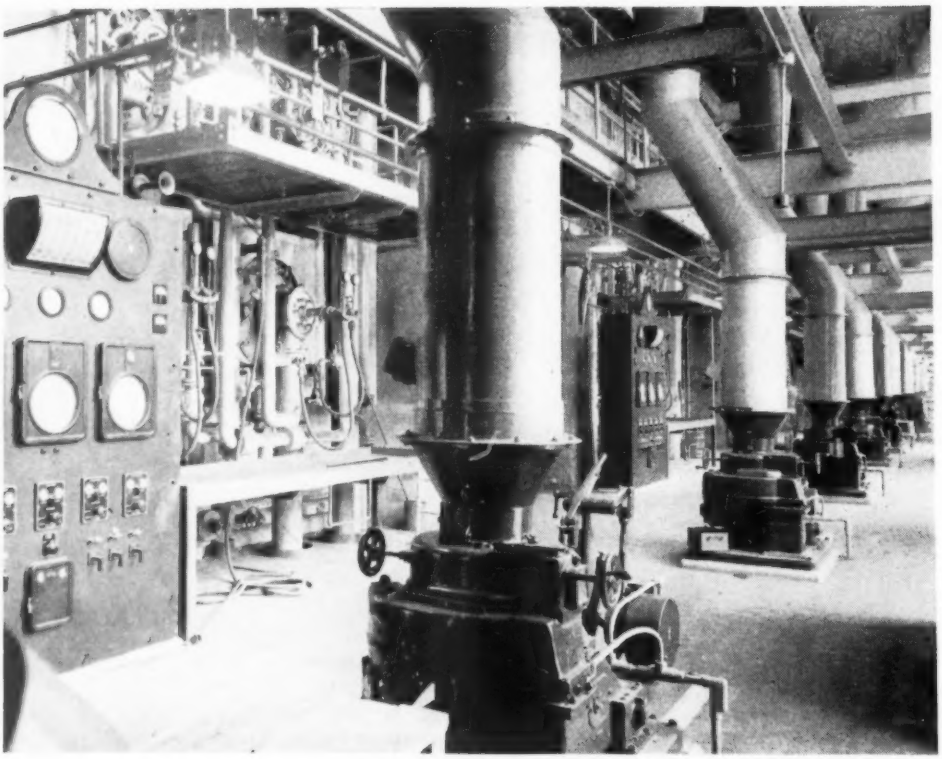
Above: Safely bedded down in the stern: Note that side of hull is not built up—Marinship follows the practice of building up stern after the motor is in place

► PICKING UP 145,000 lb of motor in one piece and dropping it in the right part of a tanker's hull takes a little doing but saves several days for hard-pressed shipbuilders. These photos show the last lap of a cross-country journey from shop to ship for one of the largest propulsion motors ever built.

Manufactured by General Electric at Schenectady, this 10,000-hp giant is more than 17 ft in diameter. Rotor and stator rode the rails separately to San Francisco, where they were assembled on a trailer truck and taken over the Golden Gate bridge to the Marinship Corp yard at Sausalito, for installation in a high-speed tanker.

Ordinarily, motors this large are installed by first securing the stator frame in the hull and then threading the rotor into it. Two 50-ton whirly cranes, a spreader, and some carefully controlled acrobatics put these pre-assembled motors into the hulls as a unit, saving war-needed time.

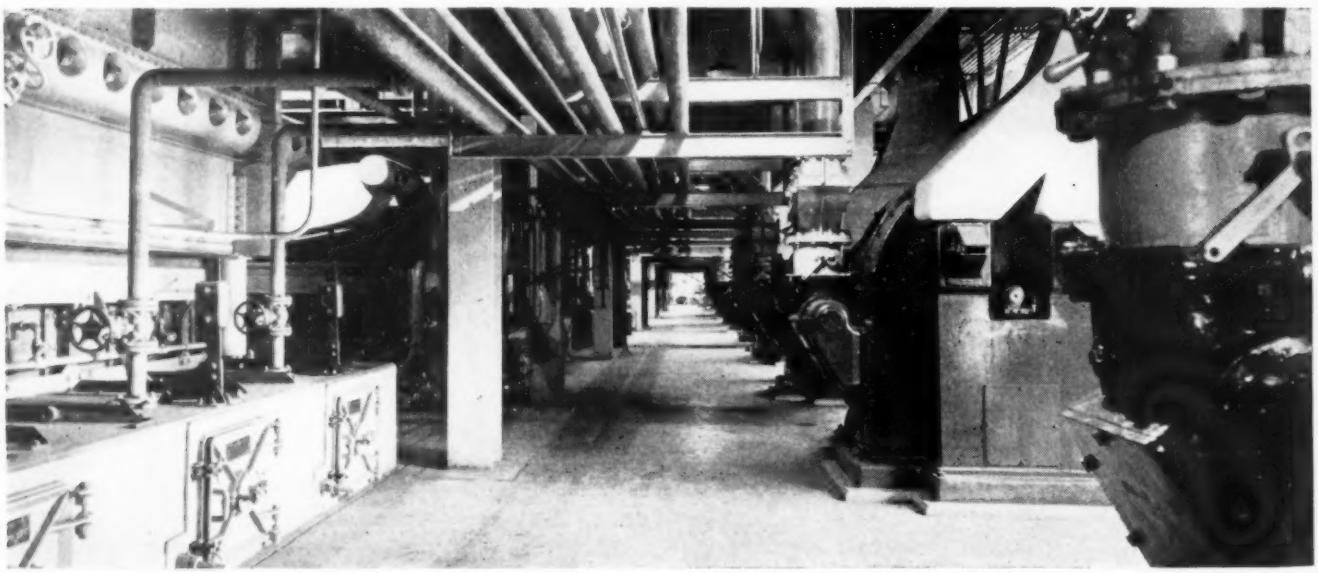
Since 1935 this company has



View of operating floor showing Riley Pulverizer feeders and burners

When a company over a period of nine years, places nine different orders for a total of 33 Riley Pulverizers, isn't it pretty good evidence that satisfactory results can be expected from Riley Pulverizers? This is not an isolated case. Here are a few of the many additional cases of repeated repeat orders:

7 orders—13 Riley Pulverizers
13 orders—37 Riley Pulverizers
4 orders—24 Riley Pulverizers
5 orders—18 Riley Pulverizers
5 orders—16 Riley Pulverizers
4 orders—11 Riley Pulverizers
4 orders—15 Riley Pulverizers
4 orders—26 Riley Pulverizers
4 orders—13 Riley Pulverizers



Eighteen Riley Pulverizers in a row—Ash hoppers are shown on the left

RILEY

STOKER CORPORATION, Worcester, Mass.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit
Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle
Portland Los Angeles Houston New Orleans Atlanta Memphis

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

Complete Steam Generating Units

BOILERS - PULVERIZERS - BURNERS - STOKERS - SUPERHEATERS
AIR HEATERS - ECONOMIZERS - WATER-COOLED FURNACES
STEEL-CLAD INSULATED SETTINGS - FLUE GAS SCRUBBERS

It will pay you to visit modern Riley Installations

installed 33 Riley Pulverizers

These are obvious reasons for preference for Riley Pulverizers

● Flexibility — Wide Load Range

Extremely fluctuating loads over a wide range are easily carried. Under favorable conditions, continuous firing has been maintained at such a low rate that no steam was generated by the boiler. Load ranges of 10 to 1 are carried at many Riley installations.

● Low Power Consumption

With Riley Pulverizers, coal is first crushed to a granular state and then finely pulverized. This two-stage principle of pulverization partly explains the reason for the low power consumption of Riley Pulverizers. Another reason is the fact that but little power is required to run Riley Pulverizers when running idle. This means very low power consumption at lower loads.

● Sustained Fineness of Pulverization

Wear of pulverizing elements of Riley Pulverizers occurs in such a manner as to have but slight effect upon fineness of pulverization throughout their life. A mechanical separating device further assures proper degree of fineness by mechanical rejection of coarse particles.

● Quiet, Vibrationless Operation

You will undoubtedly be surprised by the quiet vibrationless operation when you first see a Riley Pulverizer in operation.

● Ability to Handle Wet Coal

Riley Pulverizers efficiently handle high moisture coals not only because high temperature air can be used, but because nowhere in the pulverizing process is the coal crushed between two surfaces, but throughout is held in suspension, making possible most effective use of drying air. Primary air mixes immediately with the coal.

● Reliability

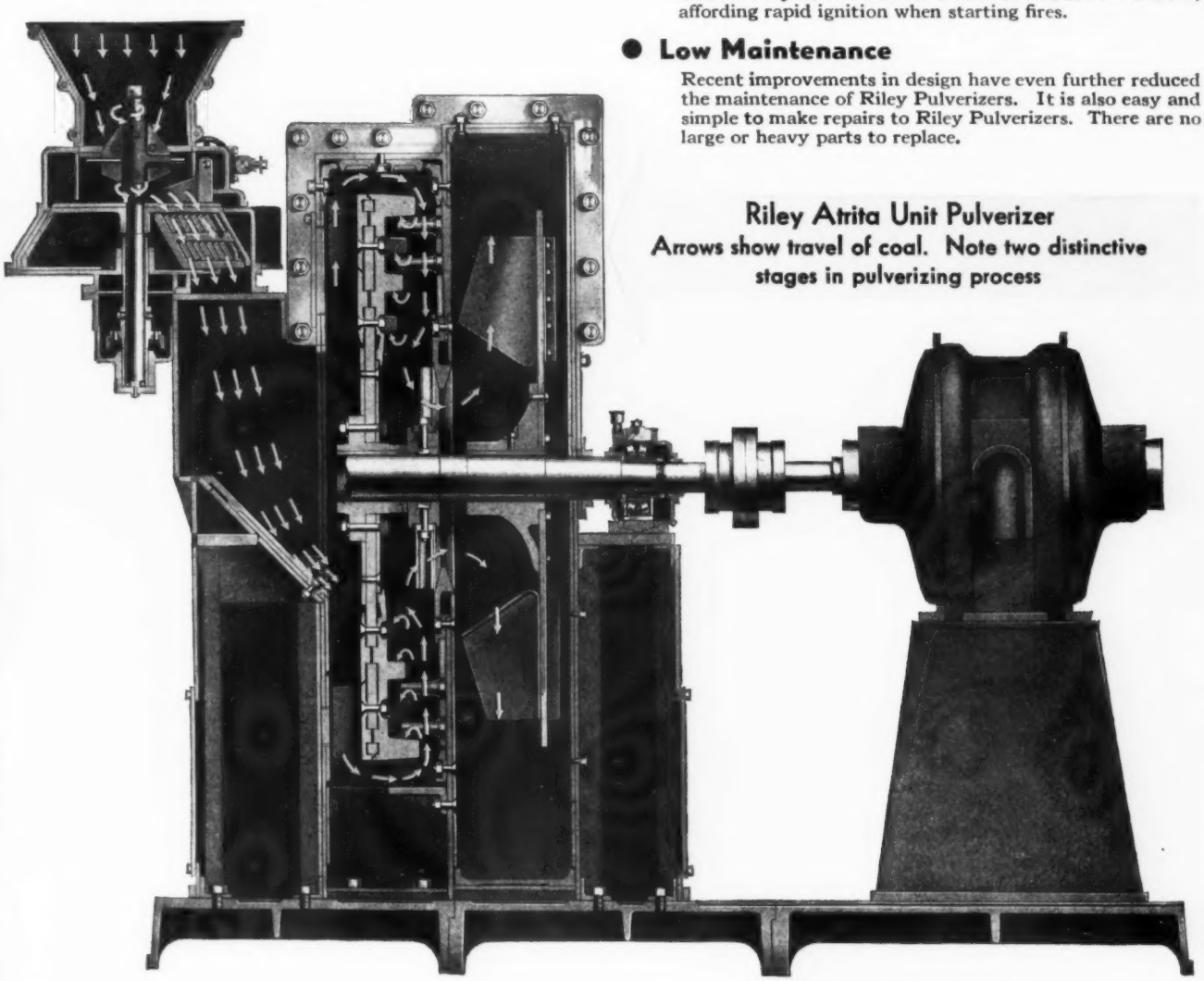
The reliability of Riley Pulverizers has been thoroughly established by performance of hundreds of these machines during the past fifteen years.

● Ease of Lighting

It is easy to light a Riley pulverized coal burner. The design of the Riley burner assures uniform distribution of alternate layers of lean and rich mixtures of coal and air, affording rapid ignition when starting fires.

● Low Maintenance

Recent improvements in design have even further reduced the maintenance of Riley Pulverizers. It is also easy and simple to make repairs to Riley Pulverizers. There are no large or heavy parts to replace.

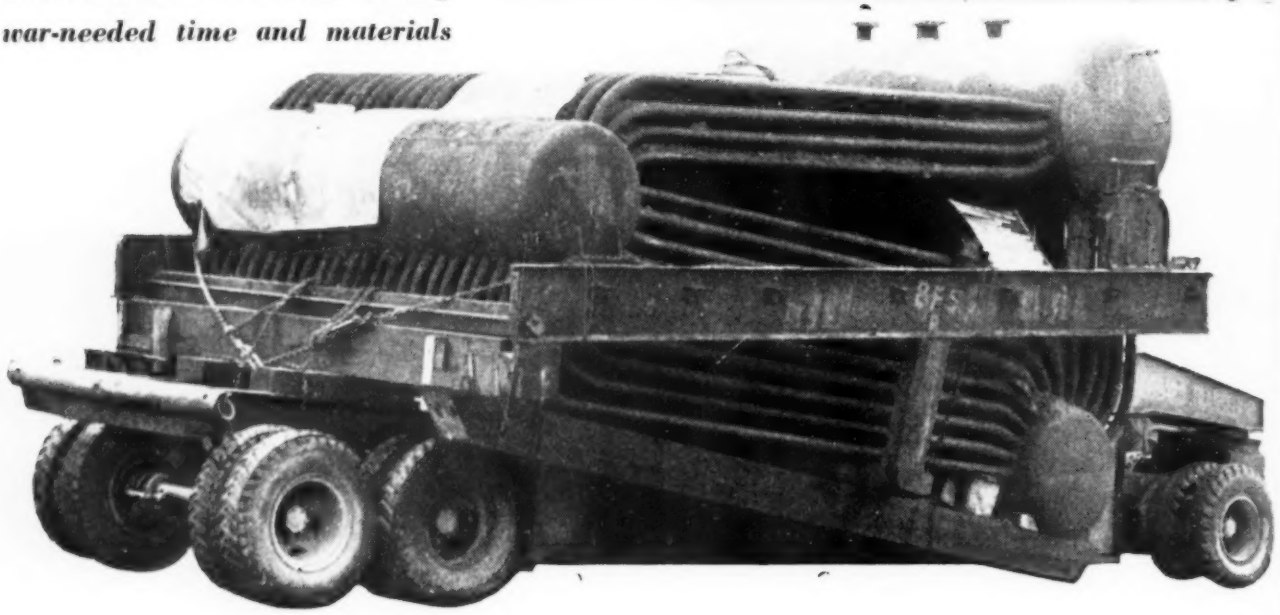


Riley Atrita Unit Pulverizer
Arrows show travel of coal. Note two distinctive stages in pulverizing process

before purchasing Boiler or Fuel Burning Equipment

Moving this Boiler Paid Because—

C C Moore Co engineers checked road clearances and available equipment to prove unit could be shipped in one piece, thus avoiding excessive dismantling and re-erection cost and saving war-needed time and materials



► Shipping small bent-tube boilers in one piece presents no exceptional problems, but for units over 3500 sq ft the job gets tough. If an existing boiler must be moved, normal practice involves cutting tubes close to drums and shipping knocked down. Re-erection requires resetting with modified drum centers and reconditioning (often rebending) of tubes. All this adds up to excessive cost and detrimental boiler changes. Shipping in one piece cuts cost roughly in half, saves time and avoids modification of pressure parts, which makes it worth-while to go to some lengths to find out if such a move is practicable in a given case. Here's how C C Moore & Co tackled one such job in the State of Washington.

The boiler in question, a Babcock & Wilcox 5070-sq-ft unit, started life at the McCormack Lumber Co, Port Ludlow, Wash. As then installed by C C Moore, it was set high for a Dutch-oven furnace fired with hogged sawmill refuse. In 1937, the Port Ludlow mill shut down and the boiler was moved as a unit, by barge, to the Rayonier Co pulp mill at Tacoma. Reset essentially as first installed, but with air-cooled combustion-chamber walls and forced draft, it turned out 200% of rating regularly.

When war conditions closed down the Rayonier mill and piled orders on the Skagit County Dairymen's Assn milk-condensing plant at Mt. Vernon, Wash., the answer to their need for quick steaming capacity lay in moving this unit. The minimum over-all dimensions of 12 ft, 2½ in. high, 14 ft, 2 in. wide and 21 ft, 2 in. long, with a weight of 59,000 lb, posed a real problem.

Checking 98 miles of highway showed minimum overhead clearance on two of many bridges to be 14 ft, 3½ in. Heavy underslung tractor trucks were found; top of floor truss stood 24 in. above pavement. Thus, with wooden deck stripped off and blowoff nozzle set between floor beams, there was just one inch to spare. Most highway was four lane, but some, and most bridges, was two.

A wooden cradle attached after dismantling brickwork was used to move the boiler from the steel suspension to the floor and through a rear-wall opening to the trailer. With an escort of three highway patrol cars, the trip, including passage through Seattle, was made in two days. Handling and moving damaged no pressure parts; on test the boiler proved drop tight and no tube ends required rerolling. Based on figures from other moving jobs of the conventional type, C C Moore engineers estimate this job cost about half as much as shipment knocked down with conventional dismantling and re-erection.

Worm-Gear Speed Reducers Boast High Efficiency and Versatile Application

Design improvements have made modern worm gears compact, efficient and reliable speed reducers. W F Plume, chief engineer, Philadelphia Gear Works, tells why and explains their application and correct lubrication

▶ WORM-GEAR SPEED REDUCERS have developed to a point where they combine high efficiency and reliability. These qualities of modern design, plus their application versatility, give them a permanent place in the mechanical power-transmission field.

Most of the earlier designs had sleeve bearings, soft-steel worms, and gears of cast iron or inferior bronze. Their housings were wrapped around the worms and gears allowing little space for an oil sump and inadequate radiation surface for heat dissipation. Modern heavy-duty worm-gear speed reducers have box housings, Fig. 1, that provide large heat-radiation area and a generous oil sump. The housing design provides rugged construction of sufficient strength to take the heavy overhung loads of the low-speed shaft extension.

Vertical housings, Fig. 2, have a dry well *W* to isolate the vertical shaft from the worm-gear oil. Both gear-shaft bearings are grease lubricated. This arrangement does not require stuffing boxes to prevent oil leakage from the gear case. Vertical gear-shaft designs are usually equipped with tapered-roller bearings. These bearings will carry radial and thrust worm-gear loads and the gear-shaft-extension overhung or thrust loads. Worm shafts have ball or roller bearings. One common arrangement uses a duplex angular-contact ball bearing on the worm-shaft blind end, Fig. 1, to carry thrust load in either direction and also radial loads. The bearing on the through end of the worm shaft floats and carries radial load only, so that slight axial expansion, caused by increased temperature, cannot pinch the bearing assembly.

Worm-and-Gear Materials

Worms are made of low-carbon alloy steel casehardened. Their threads are precision ground to close limits to insure smooth operation of the worm and gear. Worm gears are made of any one of a few bronzes of an analysis suitable for this service. There is, however, no direct relationship between physical properties of a bronze, such as its tensile strength, and its suitability for worm-gear drives.

Probably the most widely used bronze analysis for modern heavy-duty worm-gear drives is nickel bronze cast in chilled molds. Its average chemical properties are given in the table on page 100.

Unlike other gearing types, worm gears do not operate well with a pure mineral oil. An addition of 3 to 10% acidless tallow in the oil, which must be of high quality, is required to withstand the sliding action at high loads. For general conditions select a viscosity of 125 to 150 SSU at 210 F. When buying oil for worm-gear drives have a reliable refiner supply an oil which complies with AGMA No. 7 compound specifications.

After a worm-gear unit is installed

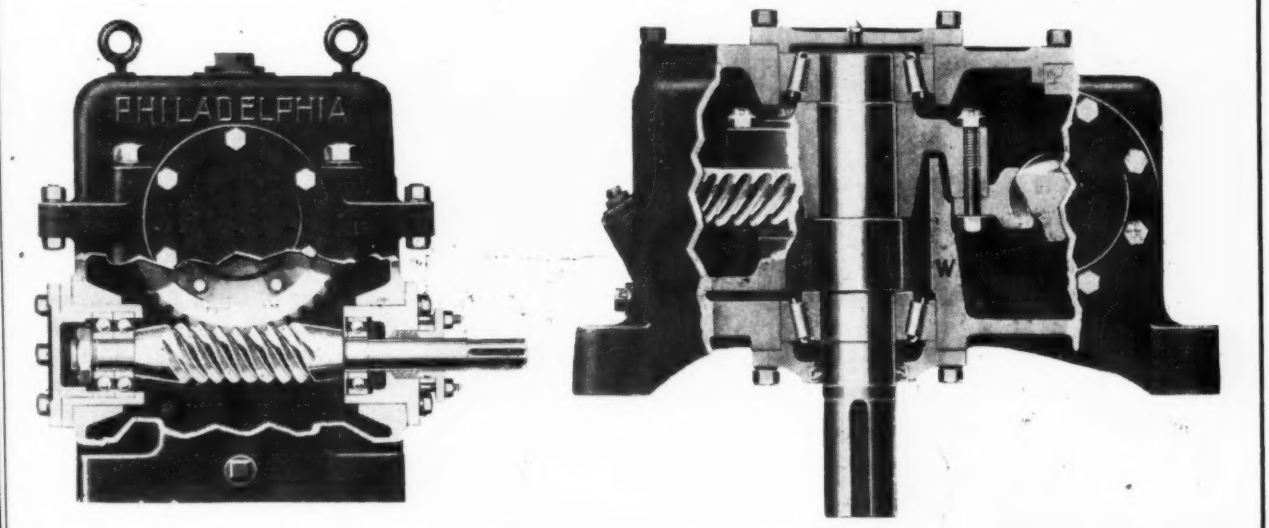


Fig. 1—Heavy-duty worm-gear speed reducers have box housings that provide large heat radiation areas and a generous oil sump. Fig. 2—Vertical-gear-shaft designs have tapered-roller bearings to take radial, thrust and overhung loads.

and lubricated the oil should be changed or filtered at the end of two weeks, thoroughly flushing out the case with light flushing oil. After this a change of oil every six months is sufficient unless temperature conditions are abnormal combined with intermittent high loads, where gear-case temperature rises and cools quickly. This may cause sweating of the case inside walls thus contaminating the oil and forming sludge. If the oil temperature goes above 150 F, or the unit is subject to wet or exceptionally moist atmospheres, or chemical fumes, it may be necessary to change the oil at 1- to 3-month intervals.

Lubricating-Oil Sludge

Sludge forms in lubricating oil by oxidation as well as moisture. It can be caused by metallic particles ground off the gears or from dust and dirt. Therefore, be careful and don't let water and foreign particles enter the gear case.

Worm-gear units are probably more versatile in their application than other types. They may have their shafts project in any direction. Fig. 1 shows a standard unit with both shafts horizontal, worm shaft at the bottom. The worm shaft could also be at the top, and either or both shafts could be double extended. Fig. 2 shows a unit with worm shaft horizontal and gear shaft vertical, and extending from the bottom of the unit but it could also extend from the top or from both bottom and top.

Fig. 3 shows two worm-gear drives connected tandem, driven by a 25-hp 1600-rpm dc motor. Gear shaft of each unit connects by flexible coupling to rolls in a textile finishing-plant drying machine. The worm gears, which have a ratio of 21.5 to 1, being connected in tandem insure that both sets of rolls operate at the same speed.

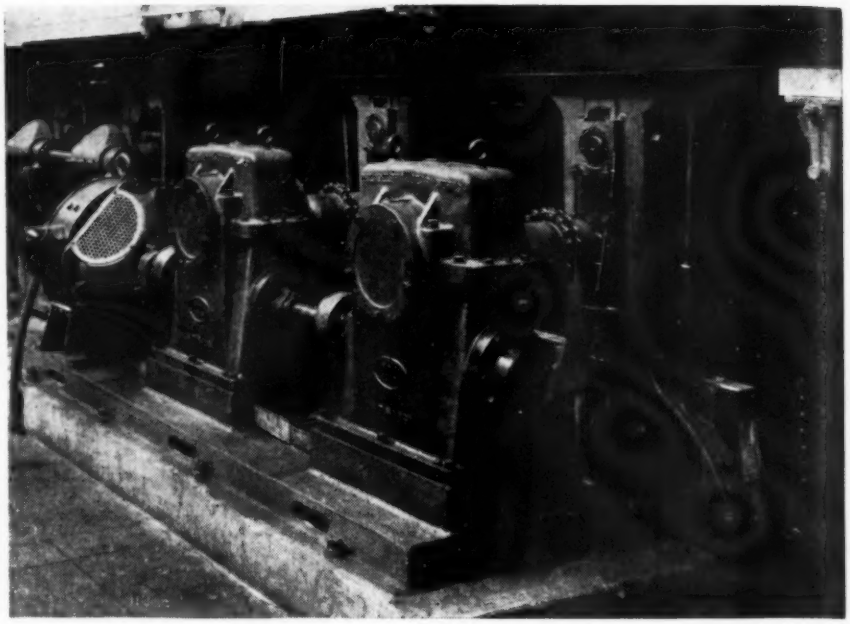


Fig. 3—Two worm-gear speed-reducer units with a 21.5:1 ratio connected in tandem and to a 25-hp 1600 rpm dc motor drive a textile-finishing machine dryer rolls

Vertical Agitator Drives

Worm gears are frequently used as vertical agitator drives. Such drives may have a built-in set of helical gears at the high speed end, and are used for speed ratios of 50:1, up to about 300:1. This design has a higher efficiency than a simple worm-gear drive, and costs less than a double-reduction worm-gear unit. In this design the motor base bolts to the housing worm-gear end, to reduce the weight below that of a conventional type baseplate.

CHEMICAL AND PHYSICAL PROPERTIES OF WORM-GEAR BRONZE

Chemical properties:

Copper	87.5%	Lead	0.25%
Tin	10.5%	Phosphorus	0.25%
Nickel	1.5%	Zinc	trace

Average physical properties of chilled portion are:

Tensile strength	47,000
Yield point	25,000
Elongation	18%
Brinell hardness	90

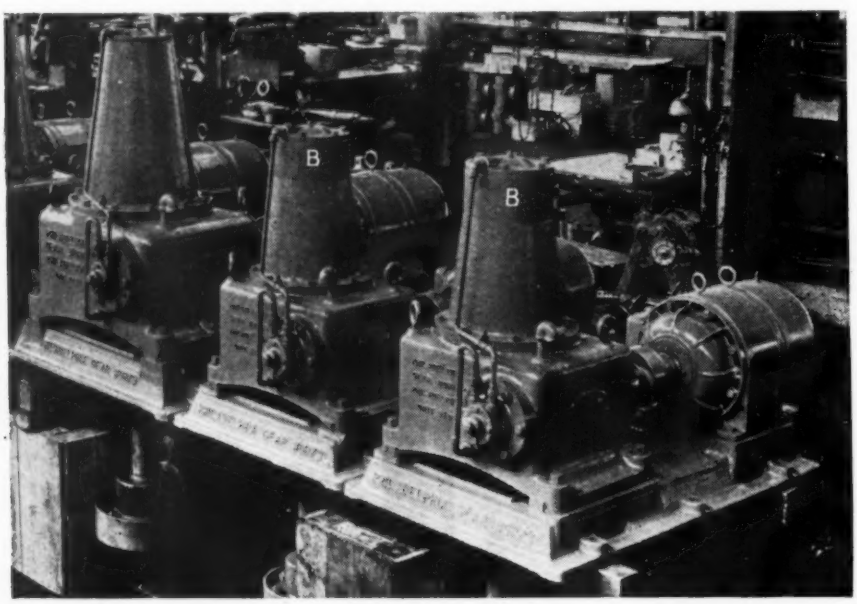


Fig. 4—Vertical-shaft worm-gear agitator drives provide a gear-shaft bearing span two to three times standard to provide support against the long agitator shaft side swing

Some agitators have long shafts with no steady bearing. Where the ratio of shaft length to bearing span is high, shaft whipping may develop. To increase bearing span in the worm gear unit, a steeple construction, Fig. 4, is used, in which the top end of the vertical gear shaft is supported in a bearing at *B*. This makes the bearing span equal to 2 to 3 times standard and provides good support for the long shaft of the agitator. The units, Fig. 4, have flanged couplings on low-speed shafts to which the agitators connect and run without guide bearings.

These are only a few of the methods of applying worm gear drives. They are also used in motorized valve operators, machine tools, turbine reduction gearing and many others, too numerous to list here, where compact, smooth-running power transmission is required.

20,000-Kw Electronic Converter Ties 25- to 60-Cycle System

At the AIEE summer technical meeting, a symposium described design, operation and performance of a 20,000-kw electronic frequency converter, largest unit of its kind, which connects a 25-cycle 44-kv to a 60-cycle 69-kv power system

▶ WITH A PROGRAM that included practically every phase of electrical engineering, American Institute of Electrical Engineers held its summer technical meeting, June 26 to 30, at Hotel Jefferson, St. Louis, Mo. At 24 technical sessions over 100 papers were presented and, in addition, other meetings and several conferences were held. The program's scope and the subjects' timeliness stamped the meeting as outstanding in the Institute's history.

Of particular interest was the symposium on electronic frequency converters, which centered around two 10,000-kw units, installed in the Edgar Thompson plant, Carnegie Illinois Steel Corp. These units transfer power at 30,000-v dc in either direction between the corporation's 25-cycle 44-kv and its 60-cycle 69-kv system, each having its own generators. The 25-cycle system has over 125,000-kw generator capacity; the 60-cycle, in addition to its own generators, connects to a public utility system with over 600,000-kw generator capacity, Fig. 2.

DC Power Transmission

Since August, 1936, the principles of electronic rectification of ac to dc, transmission of dc and electronic inversion to ac have been in commercial use in a 5250-kw installation jointly owned by the New York Power & Light Co and General Electric Co. This installation rectifies 40-cycle ac to dc, at Mechanicsville, N. Y., and transmits it at 30,000-v to Schenectady where it is converted to 60-cycle ac.

Pentode-ignitron tubes used for rectification and inversion in the electronic frequency changers, installed by Carnegie-Illinois Steel Corp, were described by H C Steiner, J L Zehner and H E Zuvers, of General Electric Co. These tubes have an anode, a mercury-pool cathode with igniters and auxiliary anodes, and three grids. The name is suggested by similarity of construction—an anode, three grids, and a cathode—to that of the pentode-electronic tube. General design is shown in the cross-section, Fig. 1, with the anode surrounded by three grids.

Starting from the anode, the first grid acts as an intermediate anode to divide potential gradients during non-conducting periods. Next, the control grid determines the starting time and reduces deionization time at the end of conduction. The outer, or shield, grid picks up the arc when conduction begins and shields the rest of the grid-anode structure from residual ionization after conduction. The cathode has three ignitors, only one of which need be used at a time. There are also two auxiliary holding anodes: one maintains cathode-spot excitation for low-anode current and the other is for control purposes. Each tube is rated about 1500 kw.

Mercury-vapor pressure in the pentode ignitron is controlled by circulating water through a jacket surrounding the tube wall. Ample mercury-condensing surface in the tube maintains low-vapor pressure during overloads and allows reasonable variation of cooling-water temperature. Sudden increases in vapor pressure, caused by flying mercury droplets hitting hot anodes and grid surfaces, are prevented by a graphite splash baffle.

Electrode Connections

Electrode connections are brought out through permanently vacuum-tight insulation bushings, consisting of high-resistance borosilicate glass sealed to fernico. All water-cooling surfaces are of stainless steel, highly resistant to corrosion. The inner cylinder is sheet stainless steel with vacuum-tight arc-welded seams. When anode and grids are assembled in the anode header, it is set in one end of the cylinder and vacuum-tight welded to it. The cathode head is similarly assembled and welded to the other end of the cylinder to com-

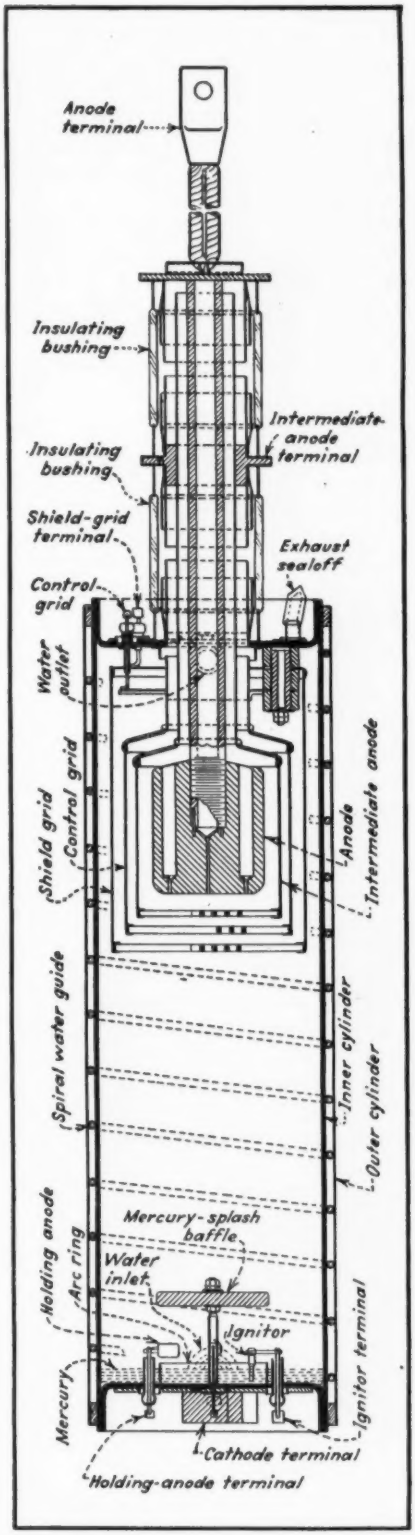


Fig. 1—Cross-section through a 1500-kw pentode-ignitron tube used in the 20,000-kw electron frequency converter

plete a vacuum-tight envelope for the tube. Then the tube is given a rigorous degassing treatment during which mercury is admitted. At the end of the degassing period, the tube is permanently sealed from the pumping system.

General sequence of operation of the electrodes in the pentode ignitron is as follows: A cathode spot is established for each conducting cycle by means of one of the ignitors. Auxiliary-anode current starts as soon as the ignitor fires. Shield and control grids are then made positive and conduction is established first to the shield grid, then to the control grid and finally to the anode.

Development and application of the pentode ignitron marks a new and advanced step in electronic tubes for power conversion. Performance and characteristics of the 20,000-kw 30,000-v electronic power-frequency converter were described by F W Cramer, Carnegie-Illinois Steel Corp, L W Morton and A G Darling, General Electric Co.

Frequency Converter

As in Fig. 2, each electronic frequency converter consists of a 10,000-kw bank of twelve pentode-ignitron tubes that rectify ac to 30,000-v dc. The dc goes through another 10,000-kw bank of twelve pentode-ignitron tubes and is converted to ac. The bank that converts dc to ac is called an inverter. That portion of the system in which dc power flows is known as the *dc link* and the combination of rectifier, inverter and dc link has been termed an *electronic frequency converter*. In this installation the dc link is only a few feet long, but it might be extended to be a long transmission line.

This type of converter was selected to obtain ease and simplicity of control, low contributions to faults, light weight of indoor equipment, high efficiency and ability to transfer a fixed value of power regardless of departure from normal frequencies of the two systems.

The converters are designed to control any constant power flow within their rating in either direction between the high-voltage 25- and 60-cycle systems. Built for industrial service, they are capable of carrying 125% load for 2 hr, and 200% for 1 min. The two 10,000-kw units are identical and may be operated in parallel when the load exceeds the capacity of one, or either one can be operated singly when the load is within its rating.

The 60-cycle and the 25-cycle transformers are alike except for frequency and primary voltage. Transformer connections for each of the 10,000-kw units are arranged for 12-phase operation.

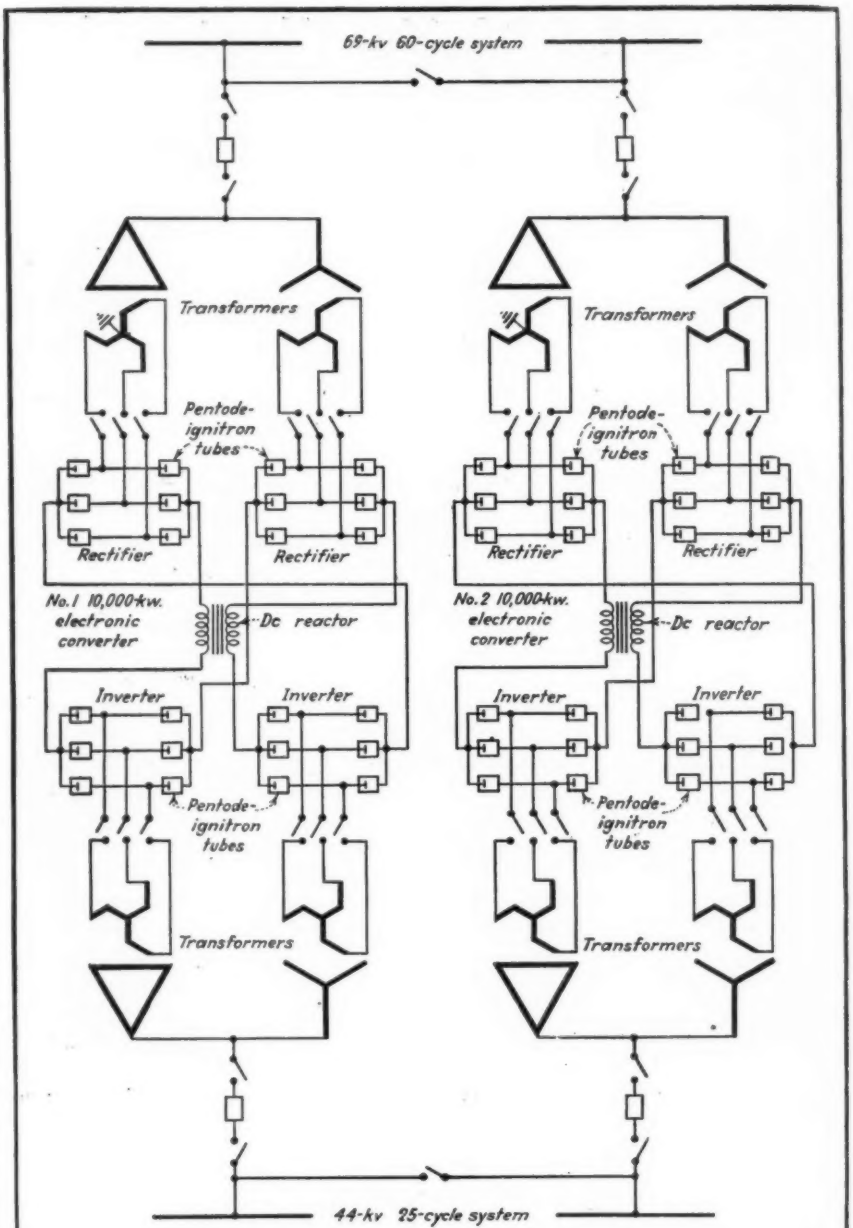


Fig. 2—Schematic diagram of 20,000-kw frequency converter consisting of two 10,000-kw units each using 12 rectifier and 12 inverter pentode ignitron tubes

The secondaries are zigzagged for a phase displacement of plus or minus 7½ electrical degrees. One 10,000-kw unit is internally connected for plus 7½ degrees and the other minus 7½ degrees; therefore, when both units are in service, they operate 24 phase.

The first 10,000-kw unit went into service Dec 6, 1943, and the second Feb 15, 1944. Since their initial operation, No. 1 unit has transferred 18,220,000 kwhr, and No. 2 unit, 5,430,000 kwhr from one system to the other. Each has carried a maximum one-minute load of 20,000 kw, a 2-hr load of 12,500-kw, and for two weeks, No. 1 carried a 12,500-kw load. No. 1 unit has operated at a load factor based on its 10,000-kw continuous rating of 68% and No. 2 of 48%.

Faults such as arc-backs and shoot-throughs in the electronic equipment are suppressed in a very short time. The rectifier cannot furnish current to a fault in its supply system. The inverter can supply only a small overload current to a fault in the receiving system. When the fault in the receiving system depresses its voltage below commutating limits, the inverter instantly ceases to commutate and consequently furnishes no current to the fault. After the fault has been cleared, normal current can be restored in a minimum of 0.04 sec and a maximum of 0.4 sec without having to disconnect the converter from the system.

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS – ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Peening Tightened This Coupling Fit

When too much clearance in the coupling joint made it difficult to line up a 3-bearing turbine-generator, the coupling extension was peened to a larger diameter

By **FRANK I MORGAN**
Pennsylvania Water & Power Co

AFTER SEVERAL YEARS, the shaft-coupling rabbet fit (coupling forged integral with shaft) of one of the steam turbine-generators in our Holtwood steam plant became enlarged, making it quite difficult to align turbine and generator shafts. Joint clearance varied, maximum being approximately 0.008 to 0.010 in. Original internal diameter of the recess was 12.000 in., but we had to machine it to 12.027 in. to form a true circle, Fig. 1.

The generator is a 3-bearing 10,000-kw 1800-rpm machine, with two of the bearings on the turbine end, and shipping its complete rotors during wartime to an outside shop for coupling repairs would have involved considerable delay. In addition, we did not wish to use machine tools urgently needed for war work. So we decided after considerable thought to machine the coupling with the rotors in place.

We anticipated no difficulty in remachining the turbine-shaft flange since this rotor is supported by two bearings,

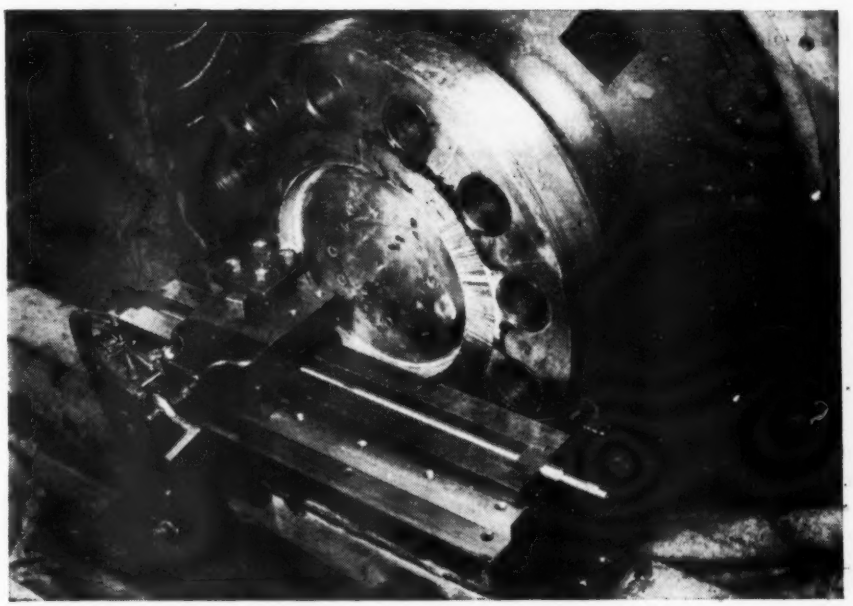


Fig. 1—Mounting the portable tool on I-beam that supports the temporary bearing and rotor end prevents beam deflection from affecting machine cut

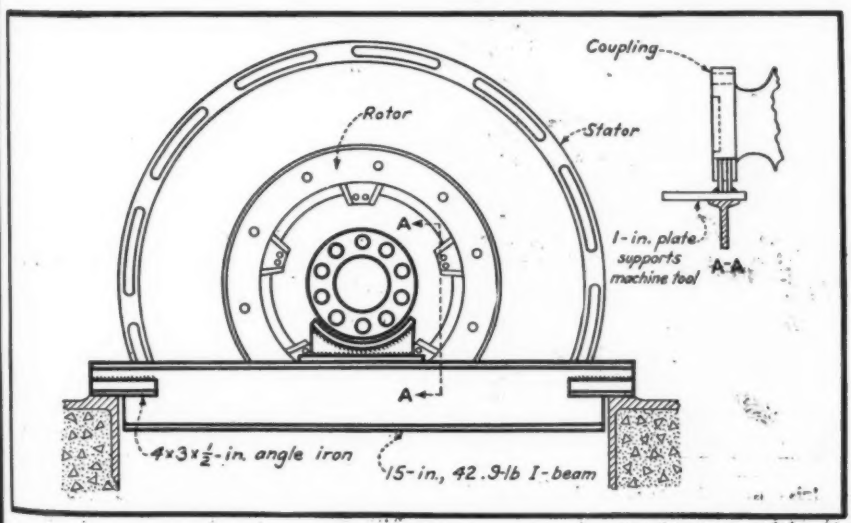


Fig. 2—Supporting I-beam resting across generator bedplate carries the babbitt-lined bearing and tool support. Section A-A shows arrangement

but work on the generator-coupling flange was more complicated because the generator has but one bearing. Because we found by measurement that the generator-coupling flange outer periphery was concentric with shaft center, we fabricated a temporary steelplate babbitt-lined bearing, in which theflange rim could operate as a journal. Bearing was supported by a substantial I-beam, whose ends rested on the generator bedplate, Fig. 2. Machining tool was supported on an extension of the bearing bottom plate, Fig. 1 and 2; thus, deflection of the I-beam, amounting to approximately 0.040 in., had no effect on the machine work's accuracy.

After removing cap and upper half of the generator permanent bearing, we inserted semicircular sections of bronze plate between the bearing ends and oil throwers on the shaft journal, to prevent shaft axial movement.

A wood pulley, Fig. 3, bolted to the generator-shaft outboard end (beyond the exciter armature) and belted to two compressed-air-driven tugger hoists provided turning power. Torque exerted by these hoists was not sufficient to start the rotor, although they were powerful enough to rotate it at a satisfactory speed after an oil film was established in the bearings. To start the rotor, we assisted the tugger hoists with a pull on the coupling flange from the hook of the generator-room crane, Fig. 4(d).

To drive the turbine rotor for machining its coupling flange, we extended the shaft's outboard end with a piece of 5-in. extra heavy pipe. This extension rode in a temporary bearing attached to the turbine frame, Fig. 5. The same wood pulley, Fig. 3, was bolted to the shaft extension and belted to the tugger hoists. To assist them in starting the

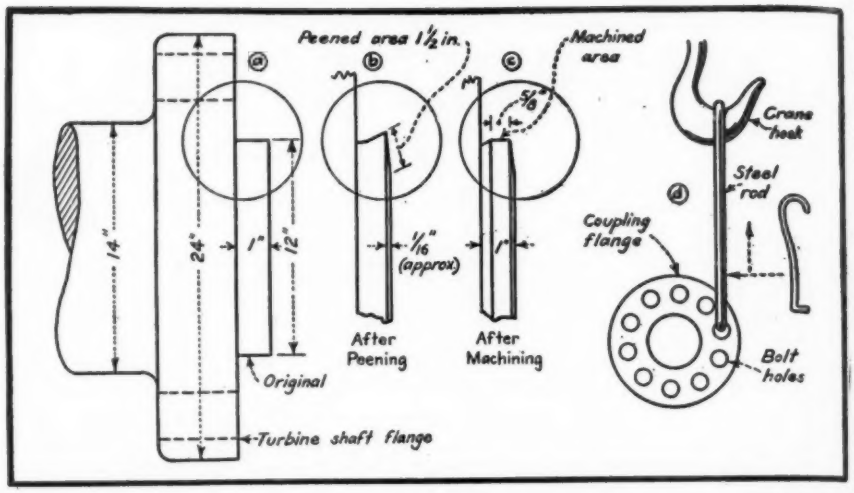


Fig. 4—Peening a limited area on the coupling extension upset enough metal to enlarge the male diameter. Machining the outer periphery restored its shape

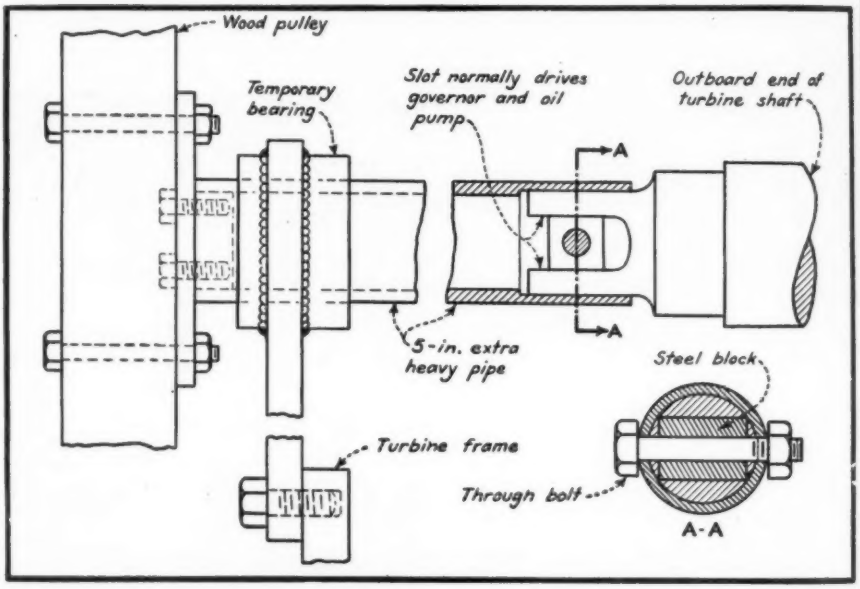


Fig. 5—Extra-heavy pipe extension fastened to the governor driving stub carries wood pulley. A temporary bearing bolted to turbine frame supports belt pull

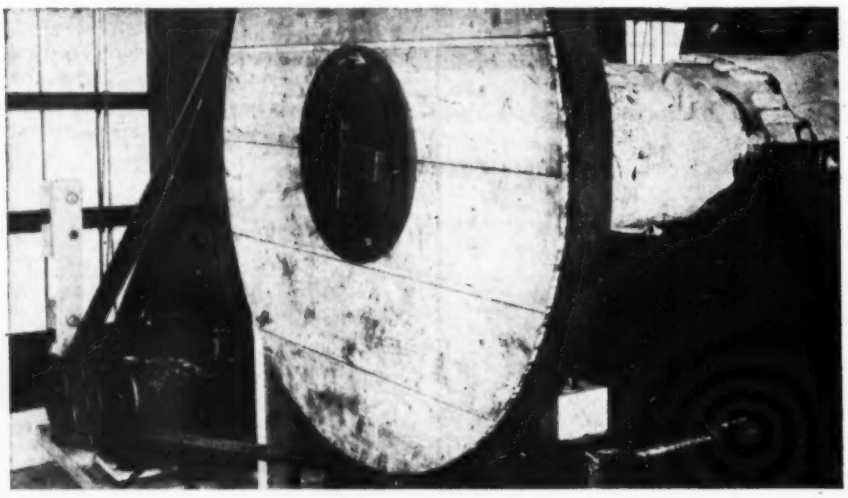


Fig. 3—Two tugger hoists with double-belt drive to pulley turned the rotor after they were assisted at the start with a pull from the generator-room crane

turbine rotor, it was necessary to use the crane again. To prevent shaft axial movement, we offset the top half of the turbine thrust bearing.

The turbine-shaft coupling flange projection, Fig. 4(a), extended one inch beyond the flange face, and since its outside diameter was too small for the mating bore, some remedy was necessary. The turbine manufacturer's suggestion that the diameter be enlarged by peening was adopted. Thus, we increased a limited section of the projection end (b) with a pneumatic hammer and peening tool. The periphery was then machined to a diameter of 12.028 in. with the same tool setup used on the generator-coupling recess. Finished surface was ⅝ in. wide (c) as contrasted with its original 1-in. width.

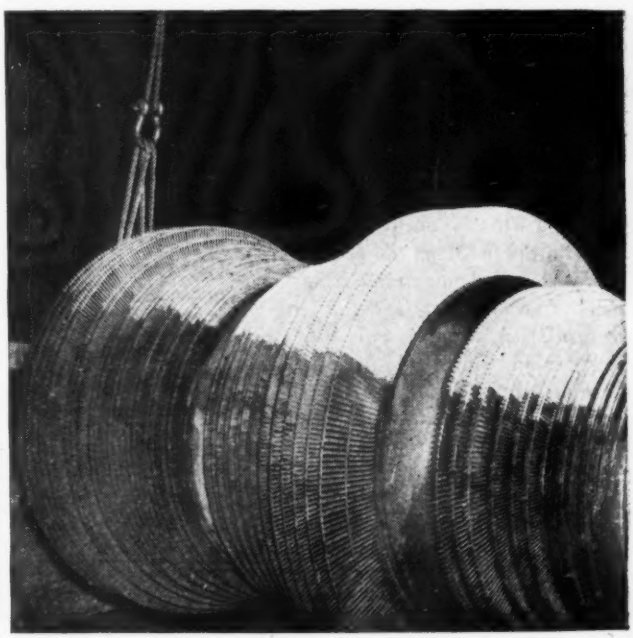
▶ AIRBLASTING a solution of pumice and water against blades has cut cleaning time of large marine turbines from 288 hours to about 16 hours, reports the Norfolk Navy Yard, where these photos were taken.

Turbine rotor is supported over a tank containing the pumice-water solution, which is mixed in nozzles and swept toward the blades at high velocity by compressed air.

Operators regulate blast by valve, conveniently arranged in the iron-pipe lance. Tip for pulverized-fuel plants: Flyash does just as well as pumice and doesn't require a purchase order or a cash outlay.

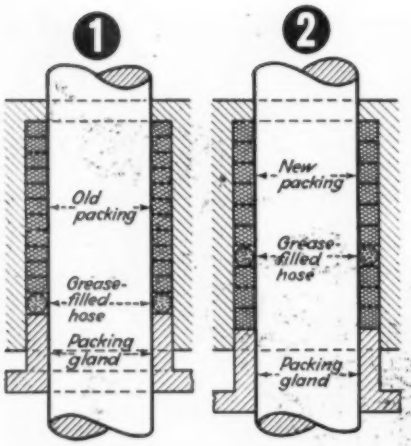
Cleaning is so complete that defects in blades or lashing wire solder are readily visible.

Official U. S. Navy photos



Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids



Grease-Filled Hose Serves as Packing

WE HAD A BAD BLOW through the packing on the hydraulic ram of our accumulator, when a new set of packing was on order, but had little hope of getting the material. To keep the old packing in service, I cut a piece of ¾-in. scrap hose long enough for one turn around the plunger. This I filled with grease and fitted in the stuffing box against the already leaking packing, Fig. 1. It held for seven weeks until the new packing arrived and was installed.

The hose filled with grease served so well with the old packing, that when I put in the new packing I substituted another section of scrap hose filled with grease for the fourth packing ring from the gland, Fig. 2. The ram is in pretty bad shape and out of round, but since installing the new packing with the grease-filled hose there have been no leaks through the packing.

Montreal, Que. — I P JONES

SAFETY BELTS FOR DANGEROUS PLACES

SAFETY BELTS are generally considered as something for linemen and window cleaners. However, their more general use by workmen operating in dangerous places would prevent many serious accidents. The electrician working on the power lines to the large transformer in the photo indicates one of these applications. The belt connected around the base of one of the insulators permits him to stand, with safety, where it is most convenient to work and have both hands free to do the job. *OEM Defense Photo by Palmer.*

Made Quick Repair to Commutator V-Ring

V-RING INSULATION in commutators of a dc motor is a vulnerable spot for grounds. This is particularly true of commutators in which the outer ends of the V-ring and clamping ring come flush. Carbon dust and oil bridges the insulation, which is only the V-ring thickness in width, and it soon fails.

Frequently the path across the insulation has sufficient resistance to prevent an immediate breakdown. But current leaking over the insulation surface carbonizes it, after which current leaks through the carbonized insulation. This process may continue until the V-ring has been destroyed for some distance back into the commutator. Before the fault is discovered it may cause a short circuit of two or more commutator bars, or the defective insulation may become incandescent because of current leaking through it. Sometimes the insulation may fail entirely and arc to ground damaging the commutator bars and clamping ring.

Replace clamping ring and the mica V-ring if they are badly damaged. On one job I made a quick repair only to find that the commutator clamping ring was next to the armature core. Therefore, to take the commutator apart it had to be disconnected and removed from the armature shaft, which was a big job.

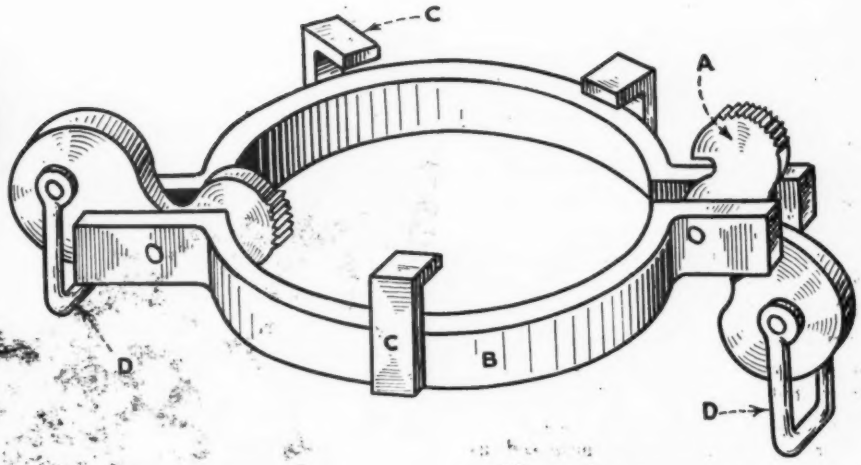
Not having time to do this I first cleaned out all the defective mica and cleaned off the damaged surface of the clamping ring. Then I filled the cavity with stiff putty and carefully re-

to Operation

moved it. This provided a template for making a piece of mica that would fit in damaged section of the V-ring. When the mica section was completed I gave it a coat of heavy shellac and pressed it firmly in place after which I pressed the cavity in the clamping ring full of iron cement and baked it hard with a blow torch.

After smoothing up the repair with a file and giving it a good coat of black insulating paint the commutator looked like new. A test showed about 9-megohms insulation resistance so we put the armature back in service. I remained at the plant several years and this repair gave no trouble.

Chicago, Ill. J B MULLENS



Lifting Device for Cylindrical Objects

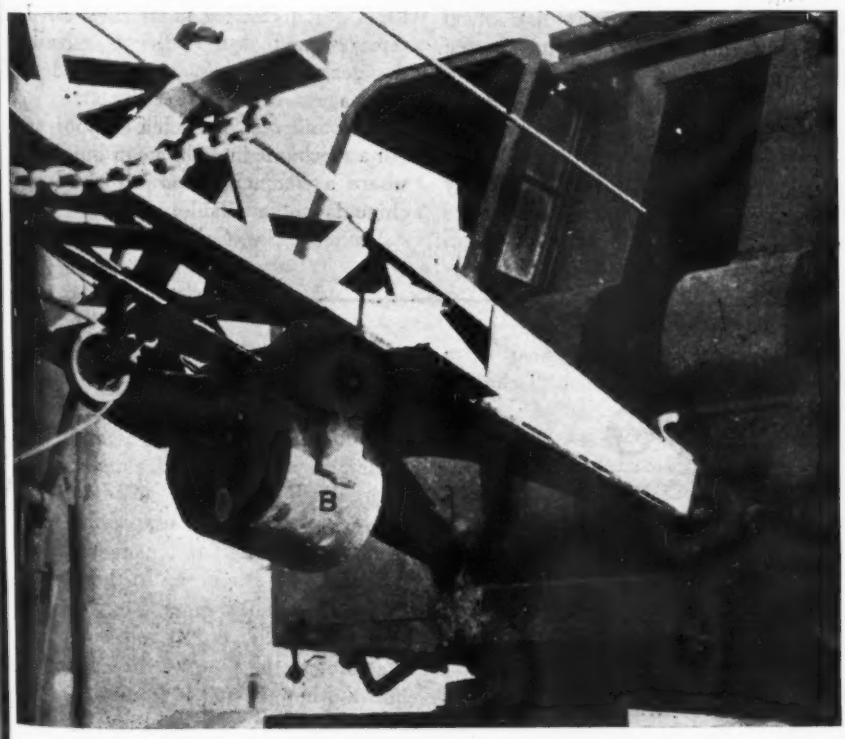
A LIFTING DEVICE for moving cylindrical objects, to which it is impossible or impracticable to attach cables or eyebolts, is saving crane-operator and crane-follower man-hours at General Electric's Schenectady works.

As shown in the diagram, this device has two pivoting jaws, *A*, on opposite sides of a ring, *B*. The jaws function like a pair of ice tongs by making weight of the lifted object exert the force to hold it securely.

Three inverted L-shaped pieces, *C*, spaced around outside diameter of the band, position the device when it is lowered over the object to be lifted. Then a crane is attached to the clevises, *D*, on the two jaws, and the subsequent lifting movement pivots them down and inward so that they hold the positioned object firmly.

STEEL BUCKET HELPS EXTEND CRANE BOOM

DURING PLANT EXPANSION and remodeling, considerable heavy equipment, such as engines, pumps and the like, had to be lifted over walls, requiring either a complicated block-and-tackle arrangement, or a crane with a longer reach than the truck-mounted one available. We solved this problem by installing on the under side of the crane boom near its base, a heavy steel bucket consisting of a short section of 12-in. pipe with a bottom welded on one end.



After welding the bucket to a sturdy base, we bolted it to the crane boom, as at *B* in the photo. This bucket serves as a base for a 65-ft wood pole, the outer end of which extended beyond the sheave end of the crane boom, where the pole was lashed to it. The pole extension does not have the strength of the crane arm, but for the comparatively light work required in the emergency, it proved a great help.

Pomona, Calif. G M WILSON

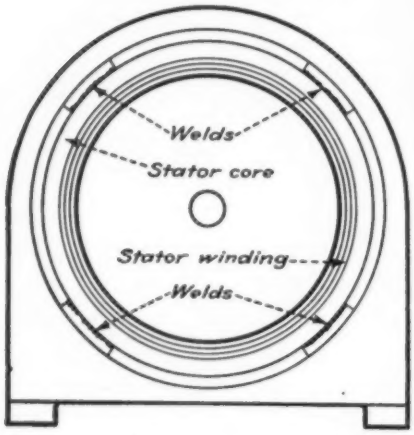
Broken Welds Cause Hot Bearings

SLEEVE BEARINGS on a 40-hp 1750-rpm 60-cycle 440-v splash-proof squirrel-cage motor got so hot that the babbitt in them melted and we replaced the motor with a spare. We installed new bearings but after a short run both stator and bearings became hot. Air-gap was checked by feelers and by sighting through the feeler holes in the housings and was found okay. Bearing to shaft tolerance was also correct. Taking a long chance a spare rotor was

substituted but trouble persisted, which was then assumed to be in the frame or laminations.

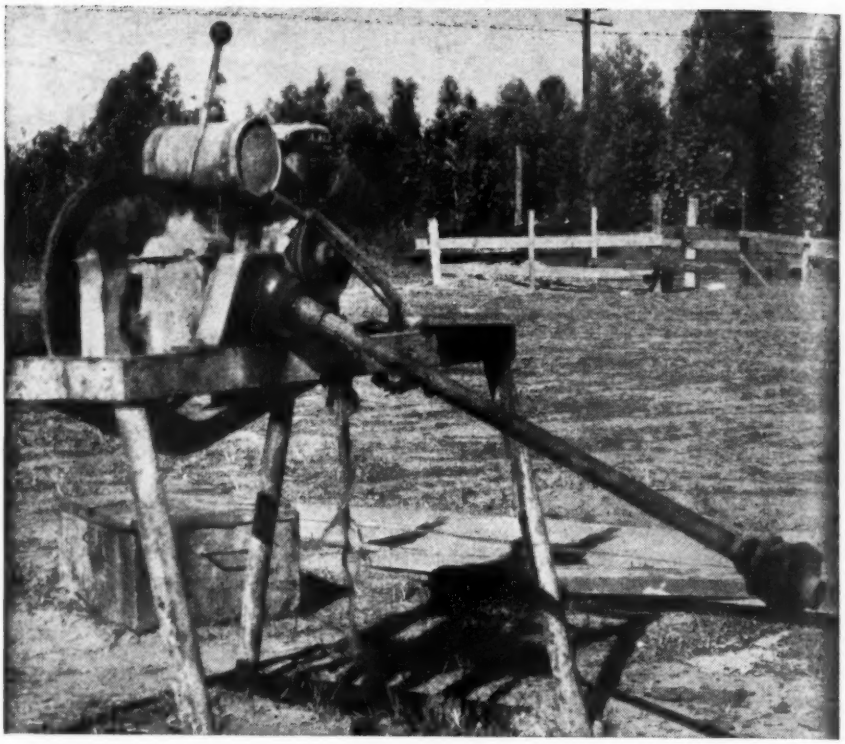
Two motor phases were connected to an autostarter tapped at the lowest-voltage position. The feeler holes in the housings were opened and a light placed at one end of the motor so that the air-gap clearance could be viewed through the feeler hole at the other end. We placed the autostarter in the start position and the stator core lifted in its frame against the rotor. This accounted for the hot stator and bearings because the magnetic pull of the stator toward the rotor increased as the two came close together. When the motor was not energized the stator core dropped to its proper position and air-gap would check correct.

Inspection revealed that the welds



holding the stator core in its frame, as in the diagram, had broken. New welds corrected the trouble and the motor operated normally.

Amhurstburg, Ont. G O ELLIOTT



BUILDS POWER DRIVE FOR PIPE THREADER

A MAINTENANCE CREW, working where there were no pipe-shop facilities, solved the problem of a power unit to drive a heavy pipe-threading machine, as in the photo. Unit consists of a small single-cylinder air-cooled gasoline engine and the gear transmission from an old automobile mounted on a suitable frame. A V-sheave on the engine drive shaft connects by V-belt to a light sheet-metal disk wheel with a V-groove welded to its rim, on the input shaft of the transmission.

The V-belt, too long for the drive, is given proper tension by a belt tightener. By releasing the tightener the threading machine may be quickly stopped. The idler sheave connects to a bracket welded to part of an emergency brake lever, with a pawl and ratchet for positioning the sheave to drive the threading machine.

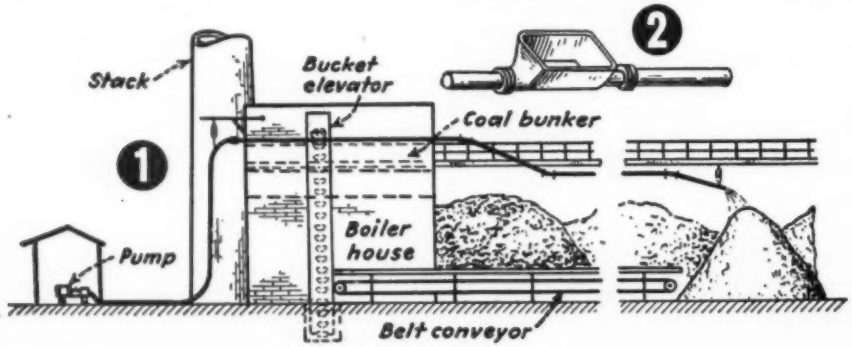
The automobile drive shaft and its two universal joints connect the transmission gear to the threading machine. To cut a thread, the threading tool is mounted on the pipe in the conventional manner, a gear-shift position selected to give correct thread-cutting speed and the V-belt tightened to its sheaves. To remove the tool the idler is released, the gears thrown in reverse, and the idler again applied to the belt.

This unit was built for outdoor use, but a mechanic in a shop can build one, where a commercial power-driven machine is not available.

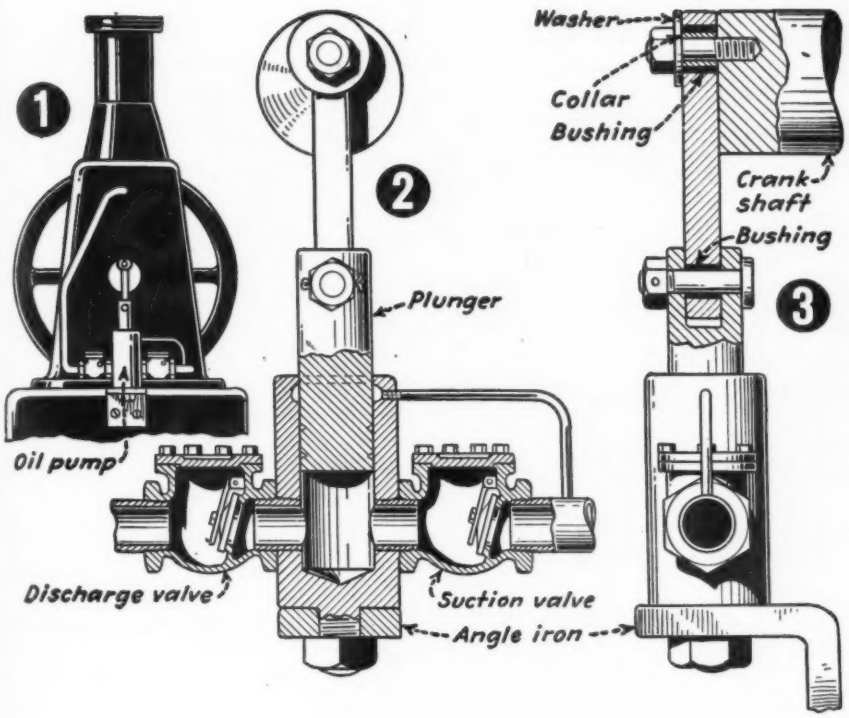
Santa Monica, Calif. J C ALBRIGHT

Puts Coal in Storage Hydraulically

MANY DEVICES have been used for stocking coal to storage, but ours may have a helpful suggestion for those who cannot get equipment. Coal is received by railroad and unloaded by a portable conveyor on a rubber belt that discharges into the loading boot of a bucket elevator. It, in turn, discharges into a chute that leads to the coal bunker.



When the bunker is full we want to discharge the coal, which is anthracite barley, to storage, and decided to do it hydraulically. Having an old steam pump we set it up to supply the water from a river. The pump connects to the coal line by a fire hose. In this line we installed a small hopper, Fig. 2, so that when the bunker is full and water flowing through the pipe we direct the coal into the hopper and it is carried along with the water, and discharged on the



MAKE OIL PUMP FOR STEAM ENGINE

I WAS A MACHINIST on an oil tanker and once shortly after we left port the chain driving the oil pump on a vertical fan engine failed. I found the chain beyond repair, so made a piston pump driven from the end of the engine crankshaft, as in Fig. 1 to 3.

The pump cylinder I made from a piece of 3-in. brass stock, which I bored and tapped near the bottom for two check valves, one for suction, the other for discharge. A 2-in. piece of cold-rolled steel served for the plunger and key steel made the connecting rod.

Most difficult job was to bore and tap a hole in the engine crankshaft end. This hole had to be parallel to the shaft axis to bring the crank pin in correct alignment with the connecting rod. To take care of any slight misalignment, the hole in the connecting-rod bronze bushings was a little oversize, Fig. 3. Two sealing grooves were cut in the lower end of the plunger which made a good fit in its cylinder to prevent breakage. To catch any leakage that worked up the plunger, I cut an annular groove near the cylinder top and connected it to the suction line by a ⅛-in. brass pipe, Fig. 2.

I mounted the pump on a piece of angle iron on the engine base, Fig. 1, and connected its suction to the oil pump and its discharge to the gravity tank within the engine casing. After the engine started the pump performed satisfactorily for the whole trip.

Great Neck, N. Y. S M ELONKA

storage pile outside the boilerhouse.

Fig. 1 gives the general arrangement. This equipment works satisfactorily and storage is easy. Coal is recovered from storage with a portable conveyor that discharges on the belt conveyor.

Fairview, N. J. MARTIN N GOZDENOVICH

File Brush Cleans Insulation Off Wires

EVERY ELECTRICIAN has experienced difficulty when cleaning stranded copper wire to get a good surface for solder. Having tired of cleaning out the valleys between the strands with a knife point, I tried a file brush and it did a better job. Applied lengthwise on the strands, the brush's short stiff wires work down between them to clean their surfaces thoroughly and at the same time slightly roughen them to improve their bond with the solder.

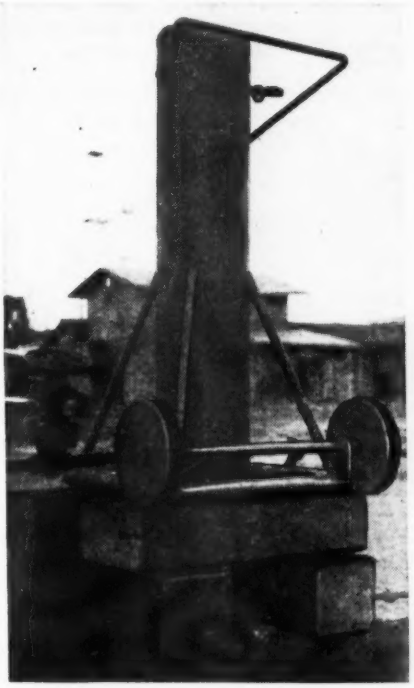
Too much care cannot be exercised when soldering lugs on cables to get a good bond and I find the file brush helps a lot. If soldering is not properly done hot connections result that may fail during heavy loads or short circuit with effects that are disastrous.

St. Louis, Mo. O C MILLS

Portable Air Cushion Reduces Pressure Surges

ON AN EXTENSIVE PIPING SYSTEM normal working hydraulic pressure of 200 psi would quickly pump to 500 to 600. To correct this the engineer built a small portable surge chamber, as in the photo, that materially reduced the pressure peaks, made operation safer and increased equipment life.

A 4-ft length of extra heavy steel pipe with welded-in heads served as the pressure vessel of the surge chamber. A flanged connection in the bottom of the chamber permitted easy connection into the piping system at any convenient point, preferably close to where the pressure surges originate. Near the top of the chamber a small cock provides for necessary draining.



When installed the chamber is charged with compressed air so that at normal pressure on the line it is about half full of liquid. Pressure surges originating at any point on the system quickly propagate in all directions and upon reaching the chamber are absorbed by the air.

For convenience in handling, the chamber is supported upright by four ¾-in. pipes on a broad square base made of 2-in. pipe, all welded together. A pair of wheels and a handle bar make the chamber easy to move from one location to another.

READERS' PROBLEMS

Questions From Our Readers

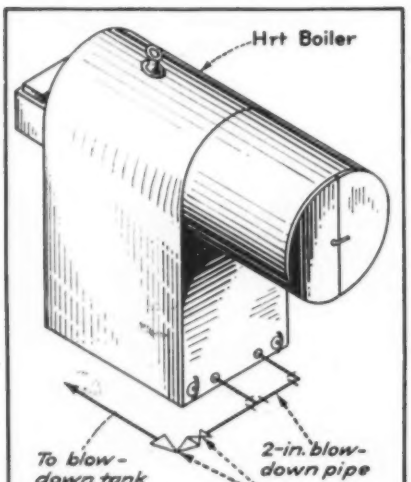
SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers that are accompanied by rough drawings or photographs will command additional pay.

Question 1

Is This Blowdown Satisfactory?

BLOWDOWN PIPING on our boilers is arranged with one set of valves beyond the two branches, as sketched. Is this correct, or should two valves be inserted in each branch line?

If we must rearrange the piping, can we use two slow-opening valves instead of one slow-opening and one quick-opening valve? What purpose is served by a quick-opening valve when we are cautioned to open it first and close it last? What alternate arrangement is safe and practical?—*BW*



Question 2

What Causes Ammonia Temperature to Vary?

WE HAVE an ammonia refrigerating system for ice making and process cooling. The two shell-and-tube condensers mount above the receivers. Water at 60 F enters the bottom, makes ten passes through each condenser and leaves at the top. Discharge water averages 74 F.

Ordinarily liquid ammonia leaves the condensers at the same temperature as discharge water, 74 F, except several days after each cleaning. During this period liquid ammonia temperature averages 4 F lower than discharge water. Head pressure variation is small.

Condenser tubes seldom show more than a thin coating of slime even after an extended run. Is it just a coincidence that the ammonia temperature fluctuates in this manner, or is something wrong with the water circulation? Would an additional pump to increase the water velocity correct this trouble?—*BHT*

Answers to June Question 1

What Causes Pressure Variation?

WE HAVE TWO HAND-FIRED BOILERS *facing two stoker-fired boilers with firing isle between. Each pair of boilers connect to a short header which in turn feeds the main steam line, the stoker-fired boilers being farthest from the load. Main steam gage and pressure control for automatic stokers connect to main steam line midway between the two sets of boilers. No. 1 and 2 are hand fired and 3 and 4 are stoker fired. Automatic stokers cut in at 85 psi and out at 95 psi. No. 2 boiler was recently overhauled and thoroughly cleaned of scale and soot.*

We experience considerable trouble when No. 2 and 4 boilers are operating. On occasions when pressure on No. 2 is 95 psi, No. 4 shows 85 psi and the main steam gage, 87 psi. No. 4 stoker cuts in when main gage shows 85 psi even though No. 4 boiler pressure has dropped to 80 psi and No. 2 boiler registers 90 psi. This procedure sometimes reverses with No. 4 boiler showing 95 psi, No. 2 85 psi, and main steam gage 95 psi.

This trouble has appeared only since we overhauled No. 2 hand-fired boiler and when we use it with one that is stoker fired. All steam gages have been checked and found accurate with a test gage and with each other.

Could this trouble originate in the boiler non-return stop valves or is it caused by unequal firing between the hand- and stoker-fired boilers? What can we do to correct this condition?—CRF

Suggests Boilers With Automatic Blowers

HAND-FIRED BOILERS should be equipped with blowers controlled by boiler pressure so that they operate like automatic stokers, that is, cut in at 85 and out at 95 psi.

When header pressure is higher than that in one boiler, its non-return valve closes. When the boiler pressure equals or exceeds header pressure the non-return valve opens and the main steam-line gage shows an average pressure. If the stoker-operated boiler cuts out, the hand-fired boiler (with automatic blower) continues operating until the pressure reaches the upper limit.

Philadelphia, Pa. T F CUNNINGHAM

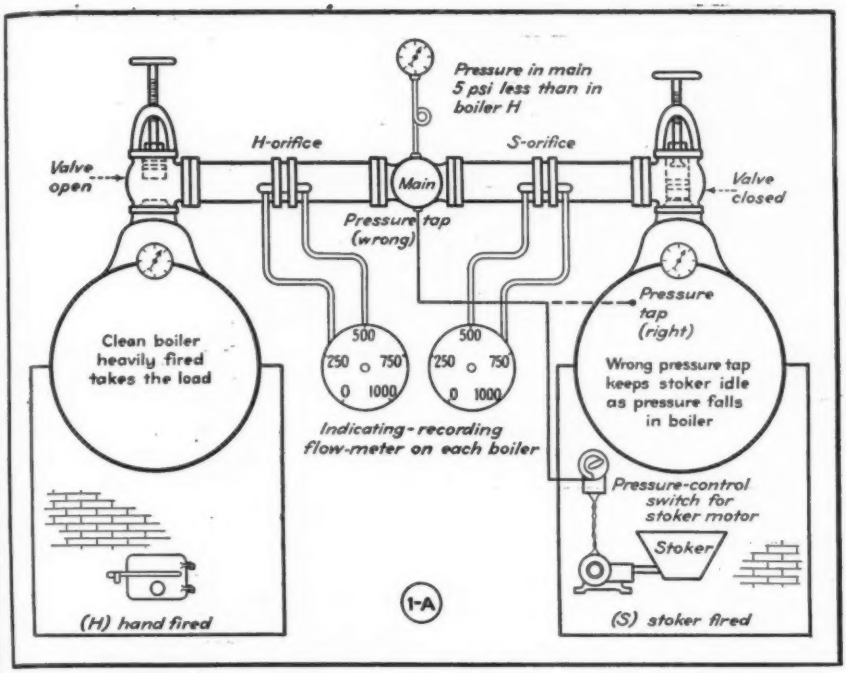
Check Regulator Water Lines

I DISAGREE with CRF's statement that the recent cleaning of No. 2 boiler caused his trouble. The first case mentioned, when No. 4 registers 85 psi, No. 2 shows 95 psi, and main steam gage 87 psi, seems to bear out his conclusion. It seems that cleaning No. 2 boiler had really done some good and that it now carries the load.

Stoker pressure control connects to the main line and cuts in at 85 psi. No. 2 still delivers that 85 psi. There is nothing wrong with No. 4 boiler regulation so far. That the pressure on No. 4 has dropped to 80 psi does not prove anything is wrong with it. But it proves conclusively that No. 2 regulation is at fault.

Regulating devices of No. 2 definitely are sluggish and do not respond to the load. To correct this condition check the regulating devices. Pilot valves may bind, or water passages on damper, balanced-draft regulators, or forced-draft-fan regulators may be clogged.

Flushing, N. Y. HERMAN KRUSE



Relocate Stoker Control Line

CRF's TROUBLE OCCURS because the automatic stoker-control pressure tap is not located properly. Main-line instead of boiler pressure governs stoker operation (1-A). Control line should tap directly into boiler steam space (dotted line) otherwise main-header pressure may shut the stoker down even when stoker-fired boiler is below cut-in pressure.

CRF could obtain better performance and possibly eliminate his trouble by installing indicating-recording steam-flow meters on the boilers. Firemen could see at a glance what each one was doing and make adjustments accordingly.

Marissa, Ill. GEORGE HOLMAN

Foreign Material in Valve

IF ALL BOILERS equalized before No. 2 was overhauled they should equalize now, provided no changes were made during repairs. Check boiler separately for non-return and stop-valve trouble. Scale could be interfering with the proper function of the non-return valve. Welding beads, pipe cuttings or pieces of gaskets also cause valve trouble. If gate valves are used the gate or wedge could drop from the spindle. See that all valves are fully open. Dry pipes, partly closed by scale or corrosion, may need replacing, if orifice plates are used in header check for restrictions.

Since this trouble occurs only with No. 2 and a stoker-fired boiler, check No. 1 with No. 3 and then with No. 4. If these pressures equalize it indicates that No. 2 is causing the trouble. It should be opened and inspected carefully.

Baltimore, Md. C D PRICE

Restricted Outlet

I BELIEVE CRF's trouble lies in the steam line or stop valve from No. 2 boiler (1-B).

Whenever No. 2 is on the line and supplying the greater amount of steam, the pressure in the main falls. When No. 4 is doing most of the work, pressure in the main is the same as that in the boiler.

Therefore his trouble must be a restriction in the valve, or header from No. 2 boiler, because the thorough cleaning increased its steaming capacity. Evidently the boiler previously was not doing its share of the work. The remedy lies in removing the bottleneck in the boiler outlet—larger stop valve, steam line or perhaps both.

Springfield Gardens, N. Y. E O'BRIEN

Gives Three Causes

AS LONG AS THE CONTROL for stokers is connected to main header, the stoker operates at header pressure. This is as it should be.

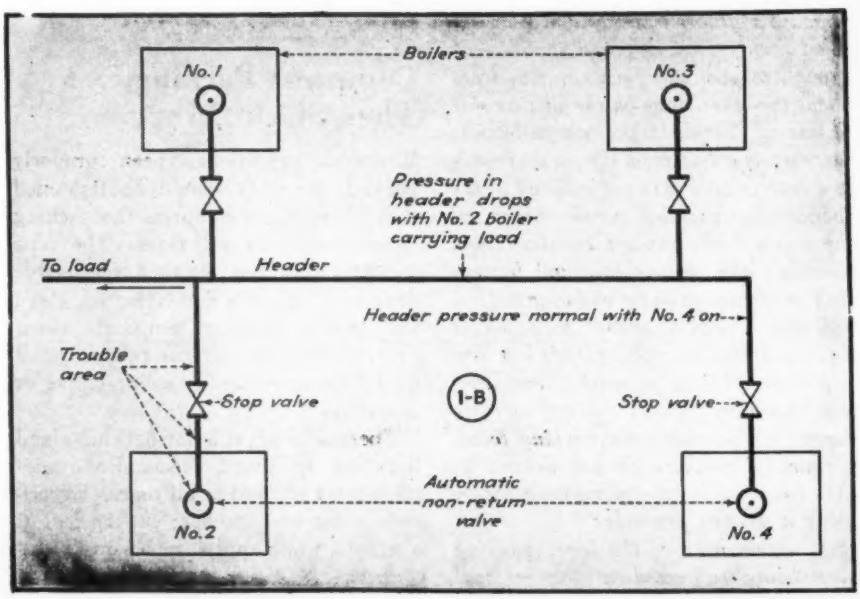
Main trouble seems to be with No. 2 boiler which CRF says registers 95 psi when the common header shows only 87 psi. This may be caused by: (1) faulty gage (2) clogged pipeline from boiler to gage which causes it to be sluggish (3) automatic non-return valve needing repair or cleaning.

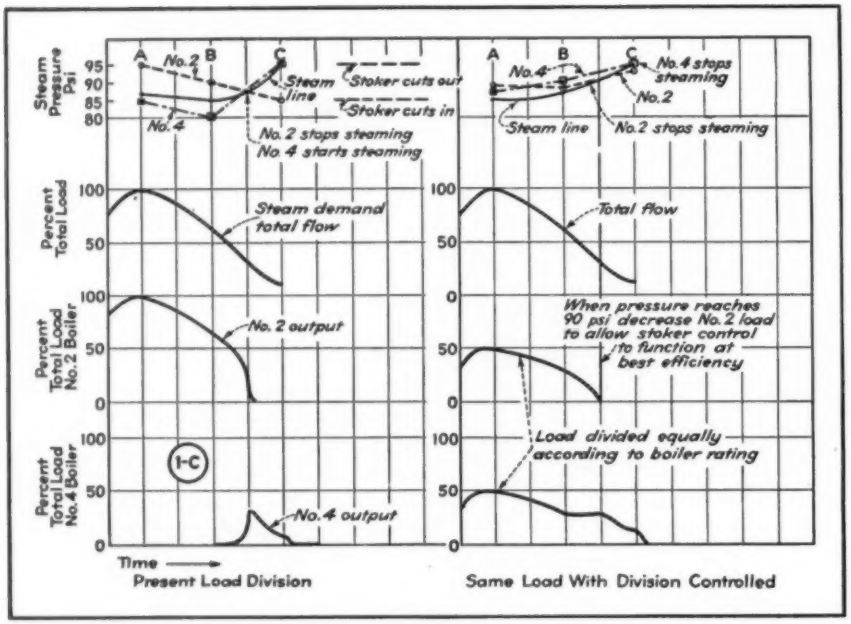
Laurence Harbor, N. J. ARTHUR CANNON

Install Draft Control

SINCE CRF's TROUBLE appeared after repairing and cleaning No. 2 boiler it is probable that unequal firing is the chief cause. Simplest correction is to operate the hand-fired boilers at a rate to keep pressure as close as possible to the stoker-fired units and not over 93 psi at any time.

Presumably the steam demand is such that on-off operation is necessary. If so, furnace draft control is essential for efficient operation. Otherwise, operators tend to set dampers for maximum operating rates. Draft controllers





on all boilers increase efficiency and greatly simplify control of load distribution between units.

Exact load distribution among units having different firing methods is difficult without meters. Make efficiency tests on both boilers to determine definitely whether improved operation would justify meters, control equipment and additional stokers. Determine total steam demand for a typical cycle by test to see whether continuous operation is feasible. On-off operation results in low efficiency.

Pressure drop of 8 psi (95–87) between No. 2 boiler outlet and main steam line indicates an extremely high rate of steaming or restrictions in the piping. For pipe and fittings of normal size this pressure drop should not exceed 3 psi. Examine non-return valve and other valves or fittings where restrictions or other faults are possible.

The accompanying graph (1-C) illustrates the probable steam distribution for the three pressure conditions. No. 4 stoker does not cut in until largest demand is over and cuts out when flow ceases, as shown by pressures equalizing. With pressure of hand-fired unit held within 2 psi of stoker-fired unit, flow rates at right of graph should result for the same total load.

Saint John, N. B. C G CLARK

Steam-Flow Meter On Each Boiler

SINCE BOILER-PRESSURE VARIATION appeared only after No. 2 boiler was overhauled, the non-return stop valve must have been leaking badly previous to overhauling. Thus pressure on No. 2 and No. 4 boilers equalized. Assuming that the leaking non-return valve

(*Continued on page* 174)

Answers to June Question 2

What Is Finger Tight?

HOW OFTEN HAVE WE HEARD *the expression, "make packing-gland nuts only finger tight," to explain how to repack a gland. Authors also say that a centrifugal pump packing gland should leak enough to cool the packing. But what about the outer rings on the suction side of pump? Single-intake pumps usually carry a water line from the pressure side to a lantern ring inserted midway of the suction-side packing gland. Since all the water leaks inward on this gland shouldn't the sealing line and lantern ring be located at outer end of gland?*

Making packing-gland nuts finger tight is simple on small glands but how is it done on large or vertical machines that use heavy glands? Isn't there more danger from leaving the packing loose, permitting pressure to get behind it, than from making the gland too tight by using a wrench properly?

A certain area of the inner packing ring being subjected to the internal pressure moves to take up any space left by a slack gland. This movement permits pressure to act over progressively greater areas of the inner ring until it is away from the gland shoulder and full pressure is compressing the packing against the gland follower. If this is true why shouldn't packing be made tight enough originally to hold it against bottom of gland?—LCR

Compress Packing, Then Slack Off

WHEN A GLAND has been properly packed, the nuts should be tightened with a wrench to compress the packing into a solid or unit mass. The nuts should be backed off to a reasonable degree of tightness depending on gland size, type of packing, temperature and pressure of liquid or gas pumped, and type of pump—whether reciprocating or centrifugal.

There is no set rule for packing-gland tightness so sound mechanical judgment must be used at all times. Experience is the best teacher: get the feel of a wrench while applying pressure.

Bronx, N. Y. ANTHONY GREER

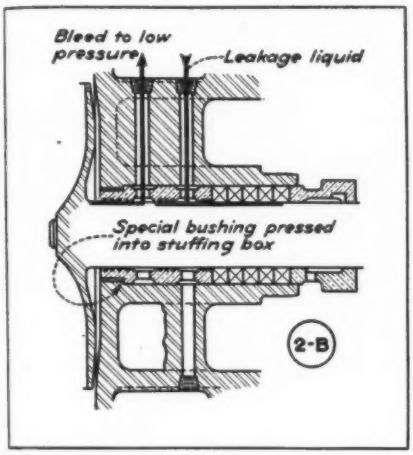
Shaft Whip Causes Trouble

SUFFICIENT LEAKAGE should flow through a packing gland to keep it cool. Amount varies with the individual operator. Liquids penetrate every minute crevice and packing must be in almost molecular contact to resist such flow successfully.

Opposed to this theory is the fact that close contact results in severe friction and drag that damages the shaft and packing. It has been my experience that the packing may score or drag on the sleeve without smoking. Always remember that the packing job is to throttle leakage and not eliminate it entirely.

In regard to leakage through outer packing rings on the suction side of the pump, the lubricating or cooling liquid is injected through a lantern ring in the middle of the stuffing box and flow takes place in both directions. Packing at the outer end of the box is usually compressed tighter and offers more resistance to this flow than rings nearer the suction side. As a result leakage into the pump is slightly greater than out through the gland.

Sometimes leakage cannot be tolerated because of corrosion, poisonous vapors, volatile vapors, freezing, possible suspended matter, or other innumerable but important reasons. The amount of admixture of seal liquid and liquid pumped is, in my experience, grossly exaggerated and many packing problems are invited because of this false assumption. The foregoing reasons are offered to substantiate LCR's statement that centrifugal pump packing should leak.



Making packing glands finger tight is applicable when only atmospheric pressure exists on the stuffing box. With higher pressure, however, the statement does not apply literally.

Experience proves that the best adjustment of a gland is careful even tightening with a wrench at regular intervals. It is imperative to eliminate, if possible, pressure differential across the gland, so as to minimize forcing the packing against the gland end for high inboard pressure. Here, the only possible means of tightening the gland is with a wrench, and no trouble should ensue if it is done evenly. It is best to use a pressure breakdown bushing (2-B) and bleed to a low-suction source to reduce pressure differential.

If the lantern rings are located at the outer end of the gland the liquid follows the path of least resistance and little, if any, travels through the packing to the suction side of pump because the least resistance is out at the gland.

Proper use of a wrench appears to be the best way to tighten packing-gland nuts on large, or vertical, machines. However, this situation is true only where the pressure on the suction side is in excess, by an appreciable amount, of the atmospheric pressure existing on the stuffing box.

Shaft gyration, or whip, often causes packing trouble. An eccentric rotation of even 0.001 in. might make it impossible to control leakage.

West Orange, N. J. R C McDONALD

Use Springs On Gland Studs

WHEN TIGHTENING gland nuts after inserting new packing, it is usual, and good practice, to draw up evenly on the nuts with a wrench to compress the packing slightly. Then slacken the nuts off and make them finger tight. Experience has proved that slight leakage is necessary for satisfactory operation, and also, that gland nuts need be only finger tight to keep leakage small.

Compressing the packing rings a small amount squeezes out sufficient lubrication for the shaft. Leaving the gland nuts finger tight, may often permit too much leakage when the pump is started. But after a short operating time the packing swells and leakage diminishes.

On large, or vertical, pumps with heavy glands it is, of course, necessary to tighten gland nuts with a wrench. Although it may not be possible to leave them finger tight they can be slackened off with a wrench and left so that they are not tight enough to cause scoring.

One method of overcoming the difficulty on large pumps is to install springs on the gland bolts (2-A). This helps to maintain correct pressure on the packing.

In a single-intake pump, it is not exactly true that all the water leaks inward on the gland. A portion leaks out if packing rings are correctly placed, lantern ring is in its proper location, and gland nuts properly adjusted. A water seal serves to: (1) prevent air from leaking into the pump (2) lubricate the packing (3) cool the shaft if sealing water is not too hot.

Placing the lantern ring at the outer end of the gland would not be satisfactory, since successive tightening of the gland nuts would eventually push the lantern ring past the sealing-water opening and prevent water reaching the packing. It is also probable that with the lantern ring in this position, the packing might be compressed tight enough to prevent water passing through the gland, and one purpose of the water seal would be defeated—that of lubrication. This is not likely to happen with the lantern ring in the middle of the gland, and with the gland nuts finger tight.

When a pump has sufficient positive suction head, lantern ring and water seal may be omitted and the space filled with another packing ring. Because with sufficient positive suction head no air leaks into the suction side and with the gland nuts properly adjusted, there is enough leakage to lubricate the packing.

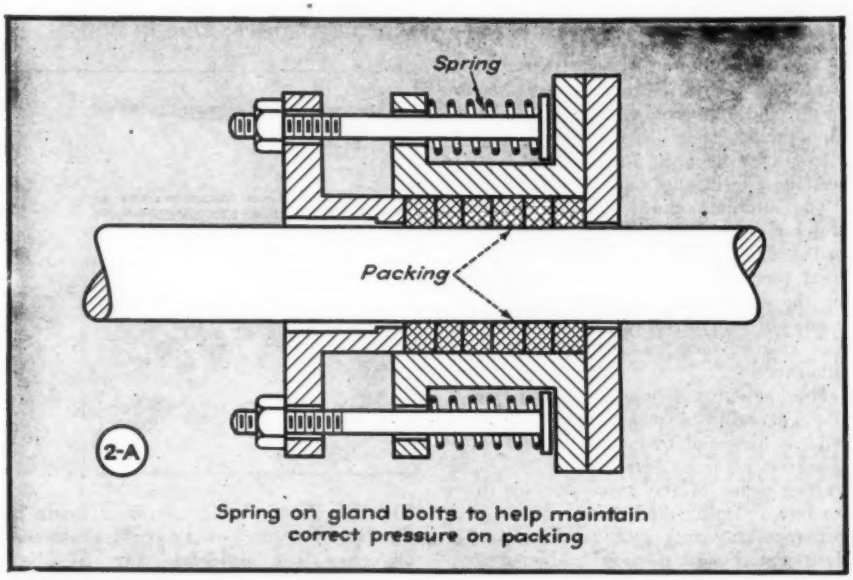
Arvida, Quebec L A PETRIE

Packing Adjustment Requires a Wrench

A PACKING GLAND WRENCH is a necessity and should be kept handy, but like many other things it should be used correctly. A slight adjustment (one hex or less) applied frequently is far better than ruining a packing set by trying to stop a week-old leak in two minutes.

Packing must be correct size and type. The rings, cut and installed to give a snug fit, must be firmly pulled

(*Continued on page* 176)



Spring on gland bolts to help maintain correct pressure on packing

Q&A — QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

17—*Hand Firing and Stoker Firing*

Seventeenth in a series that is running in every number of* POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.

Q 1—What tools are used in hand firing steam boilers?

A—They are: (a) *Shovel* spreads fresh fuel on the fire, and loads coal or ashes if they are handled by wheelbarrow. (b) *Slice bar.* Before the fire is cleaned, it breaks up clinkers that adhere to the grate. With the alternate method of cleaning fires (See Question 2) the bar sweeps fire from one side of grate to the other. (c) *Hoe* pulls out ashes from top of grate when fire is being cleaned, and cleans out the ashpit. (d) *Rake* cleans fires and spreads fuel evenly over the grate. (e) *Lazy bar* is a short bar whose ends are hooked over the door hinge and latch of firedoor and ashpit door. It supports hoe and rake when they clean fire and ashpit.

Q 2—What hand-firing systems are used?

A—(a) *Spreading method.* Coal is spread in an even layer over the entire grate at each firing, usually commencing at back of grate and working out towards the firedoor. Coal must be fired frequently in small quantities.

(b) *Alternate method.* Each side of grate is fired alternately so that the volatile gases distilled from fresh fuel will be ignited by the bright fire on other side of grate.

(c) *Coking method.* Coal is fired at front of grate and allowed to coke there. Afterwards it is pushed back and spread over the grates, and more coal is fired at the front. Thus the hot gases distilled from fresh fuel at front of grate ignite and burn as they pass over the glowing fire to rear of grate.

The alternate and coking methods are preferable to the spreading method when coal is high in volatile matter as they do not lower the furnace temperature by blanketing the entire fire surface with fresh fuel at any one time. Also, there is less heat loss from volatile gases passing to the chimney unburned.

The spreading method, though probably most generally used, is efficient only when firing is light and frequent so as not to reduce the furnace temperature below the ignition point of the gases distilled from the fuel. Covering the entire fire surface at infrequent intervals with a thick layer of fresh fuel is most wasteful and inefficient.

Q 3—Describe two methods of cleaning fires when hand firing.

A—Two methods are:

(a) *Cleaning alternate sides.* Top layer of coked fuel on one side of grate is swept over to other side by the hoe and slice bar. The clinker and ash thus laid bare are pulled out with the hoe. The coked fuel is swept back over the clean part of the grate and fresh fuel fired. When the fire again burns brightly, other side of grate is cleaned in the same manner.

(b) *Front to rear.* The coked fuel on the grate front is pushed to the rear, after ashes and clinkers have been worked up to front of grate with the hoe. Ashes are then pulled out through the firedoor and coked fuel pulled forward and spread evenly over the grate. The alternate is better than the front-to-rear method, but sometimes the latter is the only one that can be used where grates are small and firedoor narrow.

Q 4—Sketch and describe several grate bars for stationary grates.

A—A plain single grate bar is shown in Fig. 1. This is a straight cast-iron bar with side projections at ends and center to keep the bars forming the grate far enough apart to leave an air space.

Fig. 2 shows a plain double grate bar and Fig. 3 a herringbone, or Tupper, grate bar. The latter is wider and has less tendency to warp than the plain grate bar.

Fig. 4 shows a grate bar for burning sawdust, or other fine material. A large number of fine holes permit air for combustion to pass up through the grate, yet allow very little unburned fuel to drop into the ashpit.

Q 5—Sketch and describe a pyramid-type grate bar.

A—This bar, Fig. 5, has a layer of flat-topped hollow pyramids with slits in the sides through which air passes. The great number of small air openings give very even air distribution through the fire bed with no direct upward current and no large openings through which fuel falls into the ashpit. This grate is made in both stationary and shaking types.

Q 6—How are shaking grates constructed and what are their advantages over stationary grates?

A—The bars in the shaking grate are supported at both ends by pins resting on a notched side plate, and have projecting lugs attached to a long flat bar running the entire length of the grate, at the side. This bar extends through the boiler front, or connects to an extension rod, Fig. 6. Moving this rod to and fro by a hand lever or a power cylinder attached to the boiler front rocks or tilts all the grate bars. If the grate is made in two sections, two levers or rocking cylinders are used. Fig. 6 shows a shaking grate, with the bars on one side tilted as they would be when cleaning fires, and the bars on the other side flat, as they would be in the usual firing position.

With stationary grates, firedoors must be kept open when the fires are being cleaned, but with shaking grates the fires can usually be cleaned by rocking the grate

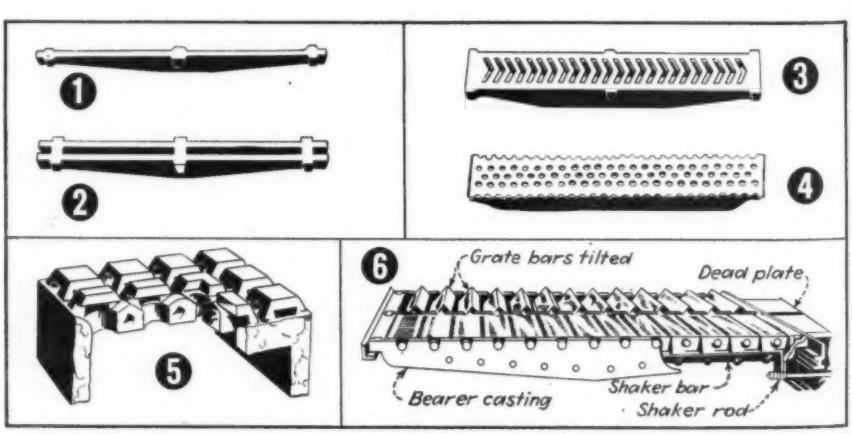
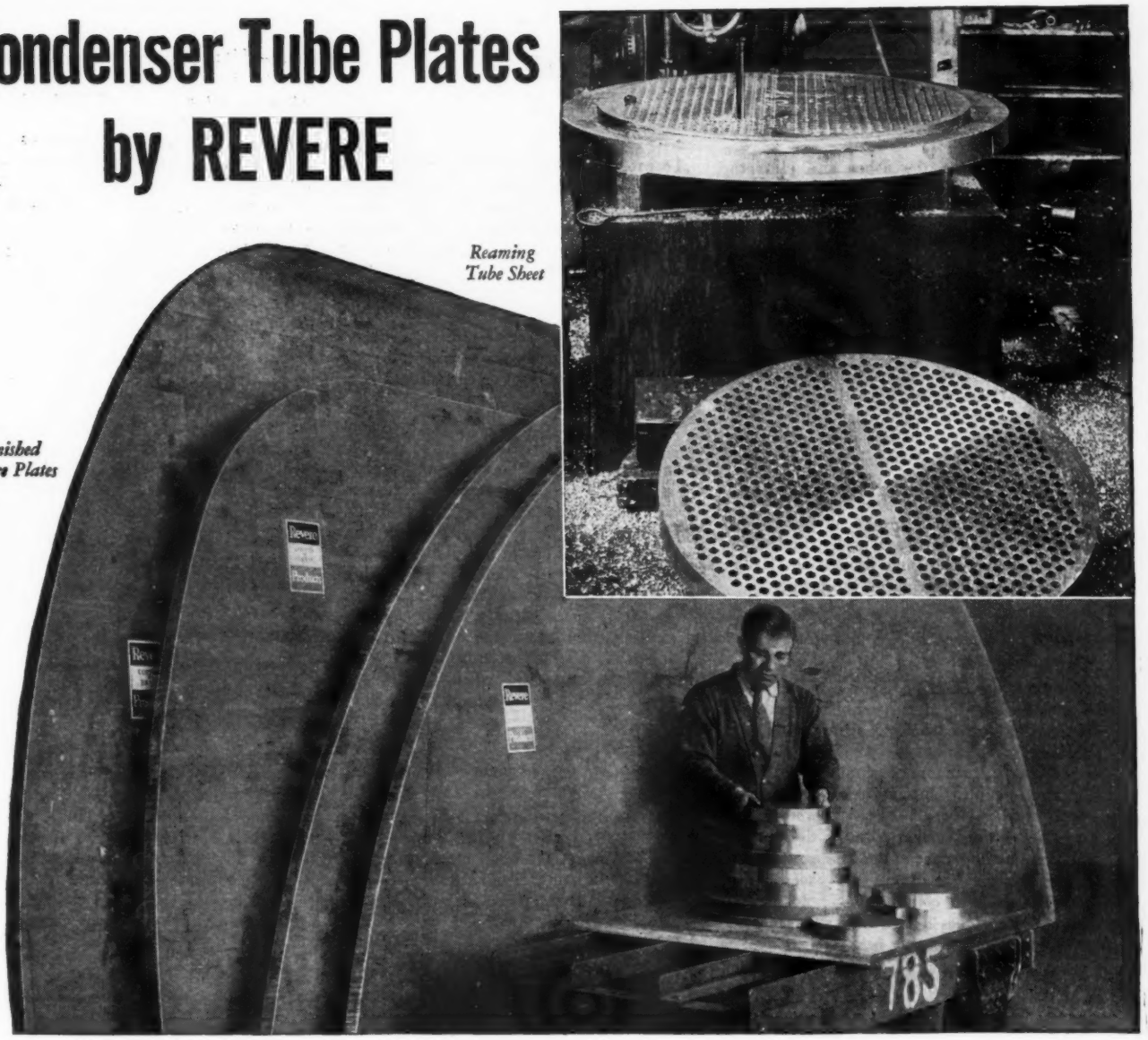


Fig. 1—Plain single cast-iron grate bar. Fig. 2—Plain double grate bar. Fig. 3—Herringbone, or Tupper, grate bar. Fig. 4—Grate bar for burning sawdust or other fine material. Fig. 5—Pyramid grate bar. Fig. 6—Shaking grate

Condenser Tube Plates by REVERE



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"The use of copper will also reduce the quantities of replacement and maintenance parts made necessary by the unsatisfactory performance of alternate materials."

—News Release from Office of War Information

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Q&A FOR POWER ENGINEERS

(Continued from page 114)

bars and working the ashes and clinkers down through the grate into the ashpit, without having to keep the firedoors open for long periods, or temporarily baring part of the grate and thus allowing excessive quantities of cold air to enter and cool the furnace.

Q 7—What regulates size of air spaces in a coal-burning grate?

A—Main factors regulating their size are the kind of coal being burned and the nature of the draft. Much coal is lost if a wide air space is used in grates burning slack or fine coal. Air openings can also be smaller if mechanical draft is used. In general, air spaces run from ¼ to ⅜ in. for small coals and from ½ to ¾ in. for larger sizes. The quantity of ash in the fuel, and the coking or non-coking properties of the coal, also have a bearing on the proper size of air space to use.

Q 8—What causes smoke and how is its formation prevented?

A—Visible smoke is composed of particles of soot formed by the incomplete combustion of the hydrocarbon constituents of the fuel. Smoke is produced if: (a) Air supply is insufficient for complete combustion. (b) Air and combustible gases are not thoroughly mixed. (c) Furnace temperature drops below the ignition point of the gases. (d) Combustion space is too small, preventting proper mixing of air and gases, and allowing gases to come into contact with cool boiler surfaces before they are ignited.

To prevent smoke formation, avoid these conditions. The air supply must be sufficient for complete combustion. Air and gases must mix thoroughly. Keep furnace temperature above the ignition temperature of the gases. There must be ample combustion space and proper baffling, where necessary, to mix air and gases and guide them on the proper path.

Q 9—Sketch a Dutch oven setting and state the advantages for this form of setting construction?

A—A Dutch-oven furnace, Fig. 7, is constructed by extending the setting so that the furnace is in front of the boiler and not directly beneath the shell or tubes. This increases the combustion space. The firebrick arch above the grates becomes white hot, thus insuring ignition of the distilled gases before they reach the cooler boiler heating surface. Where a boiler has been set too low and front space permits, this is one way to increase combustion space without disturbing the original setting. Dutch-oven furnaces are also used when boilers are fired with sawdust, shavings or other combustible refuse.

Q 10—Sketch and describe a suitable hrt boiler setting for smokeless combustion, other than the Dutch oven.

A—A form of setting for smokeless combustion is shown in Fig. 8. Arches and baffle walls insure thorough mixing and ignition of the air and combustible gases before they come in contact with the relatively cold metal of the boiler tubes.

Q 11—What provisions are made for preserving and extending the life of furnace walls in large boiler installations where combustion rates are very high?

A—Where furnace temperatures are extremely high, use special air-cooled tiles, or protect the walls by banks of tubes through which water circulates. The latter is called a waterwall.

Q 12—Why is the use of mechanical stokers preferable in most cases to hand firing?

A—Less labor and attendance are needed to operate mechanical stokers. Cheaper grades of fuel are burned successfully. More fuel can be burned per square foot of grate surface. Much higher efficiencies can be attained. Better furnace conditions can be maintained. Production of smoke can be eliminated. Firing conditions can be controlled more exactly to meet varying loads, and overloads can be carried that would be impossible with hand firing.

Q 13—Into what general classes may mechanical stokers be divided?

A—Most stokers in common use fall into one or the other of these classifications: (a) sprinkler stoker (b) traveling or chain-grate stoker (c) overfeed stoker (d) underfeed stoker.

a. *Sprinkler stoker* may be used in conjunction with stationary grates, shaking grates or even chain grates. In the last mentioned, there is no need to open firedoors or clean fires; good results are claimed for this combination. The sprinkler stoker spreads coal over the grate much the same as an expert hand fireman does with his shovel. It may be mounted on the boiler front above the firedoors, leaving them clear for cleaning fires if the grates are stationary or for hand firing if the

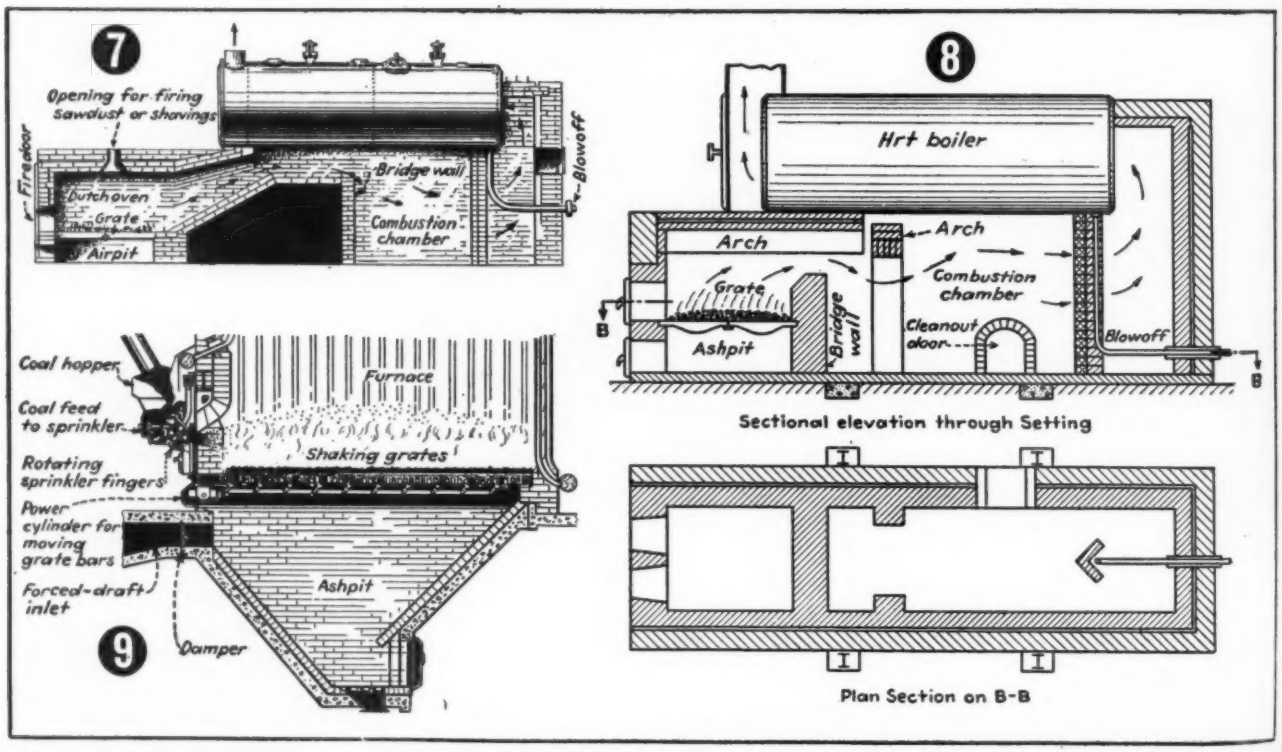

Fig. 7—Dutch oven setting for hrt boiler. Fig. 8—Hrt setting for smokeless combustion. Fig. 9—Sprinkler stoker

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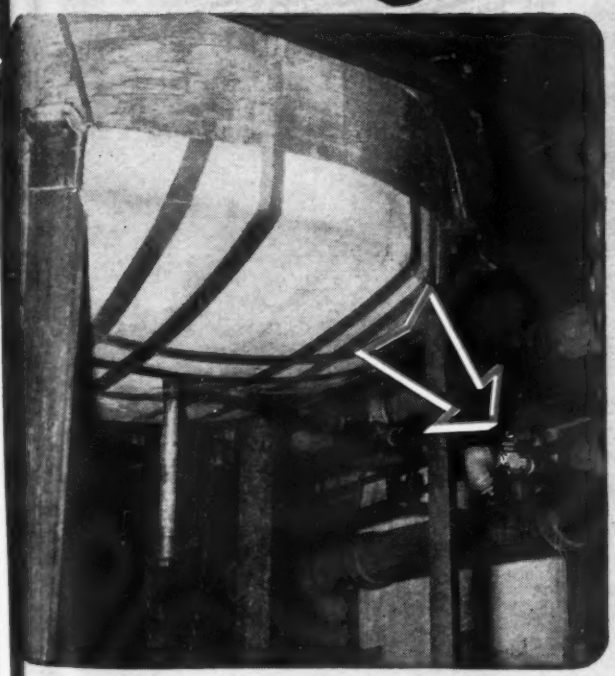
The L. H. Gilmer Company's Philadelphia Plant



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YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER-ENGINEERS

(*Continued from page* 116)

stoker should break down or be cut out for repairs.

b. *Traveling or chain-grate stoker.* Coal is fed onto the front of a revolving grate, and burns as it travels towards rear of grate where the ashes are dumped over the back.

c. *Overfeed stoker.* Coal is fed onto a stepped reciprocating grate, either at the front or the side, and is gradually consumed as it travels towards the rear or the bottom of grate.

d. *Underfeed stoker.* In one form, coal is fed into one or more deep retorts by power-driven rams and overflows onto side grates or dead plates which slope downward to dump plates that can be tilted to dump ashes when necessary. In the other type, grates slope from front to rear, and coal is also fed by power-driven rams into narrow retorts between the grate bars, whence it flows over onto the grates. The grates have a reciprocating motion that moves the coal downward to dump plates at the bottom that discharge the ashes to an ashpit or hopper.

Chain-grate and overfeed stokers in small or medium-sized power plants may operate on natural, induced or forced draft. Traveling or chain-grate stokers in large plants are usually constructed for forced-draft operation. Because of the thick fuel bed, the underfeed stoker is essentially a forced-draft stoker.

Q 14—Sketch and describe a sprinkler stoker.

A—Fig. 9 shows a forced-draft sprinkler stoker with power-operated shaking grates. Firing doors are fitted to the boiler front beneath the stoker so that the boiler may be hand fired if the stoker is stopped for any reason. When the stoker operates, a reciprocating feed plate feeds coal from the hopper into a compartment containing a revolving shaft with metal fingers that sprinkle coal over the fire with a spreading action. Rate of feed and sprinkler shaft speed can be adjusted to suit the boiler load. In some types of sprinkler stoker parts that are exposed to excessive heat are water cooled.

Q 15—Describe construction and operation of traveling-grate and chain-grate stokers.

A—In the *traveling-grate stoker* the small castings forming the grate surface are fastened to heavy transverse bars that are in turn attached to sprocket-driven chains. In the *chain-grate*, the small grate castings are linked together by transverse rods and the grate is driven by sprocket wheels engaging special sprocket links. Both grates form a continuous chain or band, and the process of combustion is the same in either case. Coal from a hopper is fed onto the front part of the grate through an adjustable door which regulates the thickness of the fuel bed.

Speed at which the grate travels should be regulated so that the coal is entirely burned to ash when it reaches the rear of the grate. The ashes fall over the rear of the grate into an ashpit or ash hopper which is usually emptied at intervals by a conveyor. With induced draft, the ashpit is open and air passes up freely through the grates. With forced draft, the ashpit is closed and the space inside the grate is divided into compartments or zones, thus enabling the air supply to be regulated to different parts of the grate to meet combustion needs. A side view of a forced-draft chain-grate stoker is shown in Fig. 10.

Q 16—Sketch and describe a front-feed overfeed mechanical stoker.

(*Continued on page* 184)

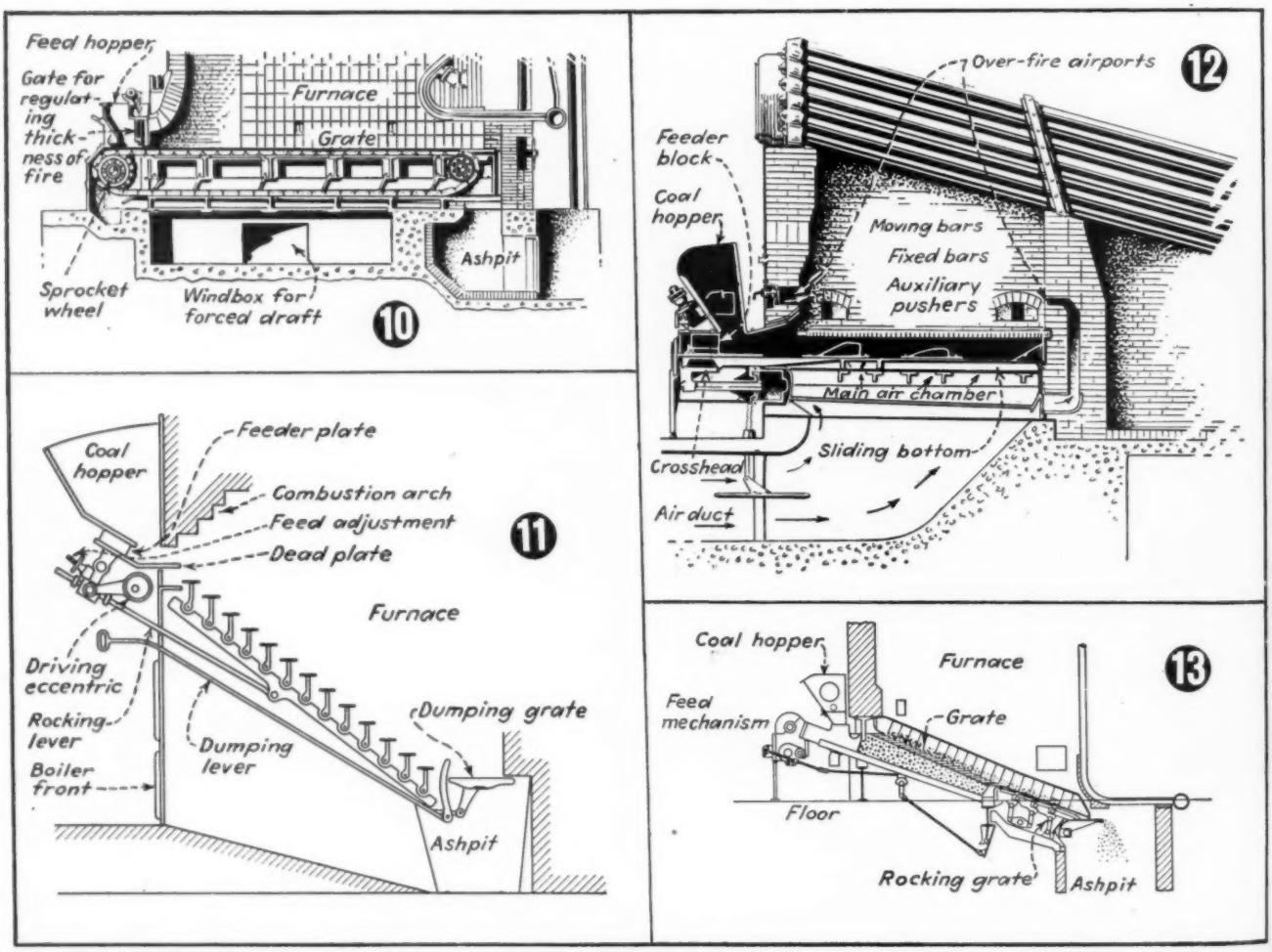

Fig. 10—Chain-grate stoker, forced draft. Fig. 11—Overfeed stoker. Fig. 12—Single-retort underfeed stoker with inclined side grates and forced draft. Fig. 13—Underfeed stoker with grate inclined from front to rear, forced draft

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REFRIGERATION NOTEBOOK — 14

Select a Compressor That Fits Your Needs

By TERRY MITCHELL, ME, *Frick Company*

NOW THAT THE ARMED FORCES are taking most of the refrigerating machines produced, it is more than ever important that commercial users, fortunate enough to get a new machine, carefully select equipment suited to their needs.

Just ordering a 50-ton compressor is not enough. Consider whether the load is spread out evenly over the 24 hours of the day and night, or whether the machine must carry the major part of the load in less time. All refrigerating machines are rated on the basis of continuous 24-hr operation. For instance, if the main cooling load in a dairy is handled in six or eight hours, the machine has to be three or four times as large as if the load were evenly distributed over a longer period.

Compressor Capacity

Capacity of a compressor varies directly with its speed, provided it is not run so fast that its efficiency drops off. Many compressors are now installed with 2-speed motors or two sizes of motor pulleys. In such cases one should be sure the flywheel effect, which varies as the square of the speed, is fully adequate at the slow speed.

Machines built to handle Freon-12 can generally be adapted to methyl chloride or even sulphur dioxide. War shortage of low-pressure refrigerants has made ammonia equipment again preferred on many commercial jobs.

Operating pressures are the next most important factor in determining capacity. As suction pressure on a machine goes down, it loses capacity much more rapidly than when head pressure goes up. A 10x10-in. inclosed ammonia machine working at 25-psi (gage) suction pressure, and producing 73.9 tons of refrigeration, produces only 44.4 tons if the suction is reduced to 10 psi. This is a loss of about 40%. With a given suction, the head pressure can be raised from 185 to 200 psi with a capacity loss of only 5%.

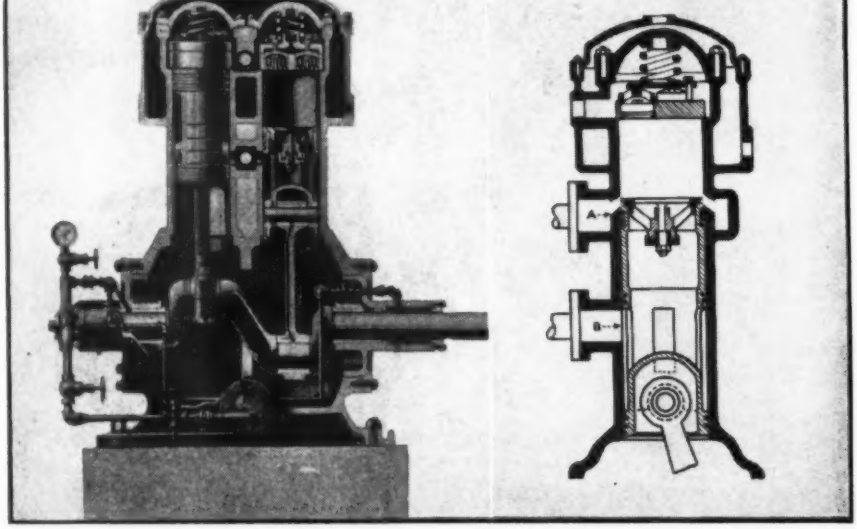
But before deciding at what pressures the machine will run, do everything possible to raise the suction pressure and lower the discharge pressure. If the ratio of compression is more than 6 or 8 to 1, a booster machine is indicated; this, if properly tied in with intercoolers, greatly increases economy on low-temperature work. In ice-making plants it often pays to precool the water and liquid ammonia at high suction pressure, this being accomplished with a dual-pressure machine. Fig. 2 shows how the medium-pressure gas at *A* raises low-pressure gas *B*, from the freezing tank and storage-room coils, to its own pressure.

In recent years the vertical single-acting inclosed compressor has all but driven other designs from the market. Horizontal double-acting units are no longer carried in stock by all manufacturers. The inclosed machines, with their balanced vertical operation, one-way gas travel, small floor-space requirement and automatic lubrication, adapt themselves to any drive so easily and require so little attention that they usually get preference regardless of size. All except the smallest ones now have forced-feed lubrication throughout. The larger sizes, from about 9x9, up, should have (in addition to the gear pump, Fig. 1, which circulates the oil) a sight-feed lubricator, which forces a drop of oil at a time into the suction manifold and cylinders on the side where pressure from the connecting rods tends to cause wear.

Investigate features, such as whether the bearings are easily renewable; see that the pipe connections and control valves are of ample size; check the method of preventing oil pumping. Is the bypass full size? Is the stuffing box deep and well lubricated? How can scale be removed from the water jacket? Are the valves of ample size, quiet operating, and dependable?

Compare Machine Volumes

Just what an inclosed machine will do under any given set of conditions is now so well known that a buyer can check the claims made by the different manufacturers if he will compare the volumes swept by the pistons in the various machines offered. Remember that in the average case it is seldom possible to test the actual output of a machine after it has been installed. Many more gages, thermometers and other measuring devices are required than are generally available: It is also difficult to obtain a steady load and uniformly dependable readings.



1—*(left)* Drilled crankshaft receives oil from small pump. 2—*(right)* Medium-pressure gas from *A* enters cylinder after it is filled with low-pressure gas from *B*

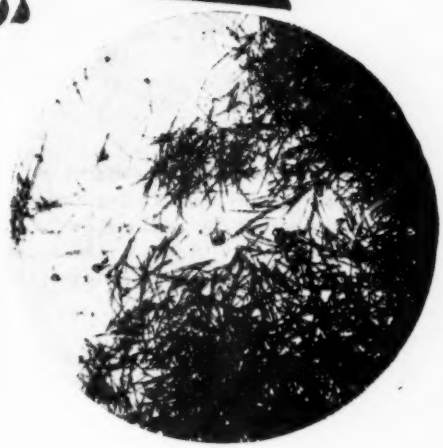
PICTURE OF A PIPE...

IN A "Picklement"

NALCO stabilizing treatment is specially designed to prevent scale formed by water in equipment wherein there is no evaporation by application of heat, such as in pumps, cooling systems, condensers, water systems, feed lines, diesel engines, etc. To keep your system scale-free, write to Nalco now—and ask for Bulletin 28S.

HERE'S HOW IT GOT THAT WAY ▸▸

Highly magnified view of calcium carbonate crystal formation which resulted in incrustation of water system, requiring costly maintenance, repair and replacement.



★

HERE'S HOW TO PREVENT IT ▸▸

Same water and conditions as above, but stabilized by Nalco so as to prevent crystal formation and maintain a clean, scale-free water system.

Nalco

SYSTEM OF WATER TREATMENT

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

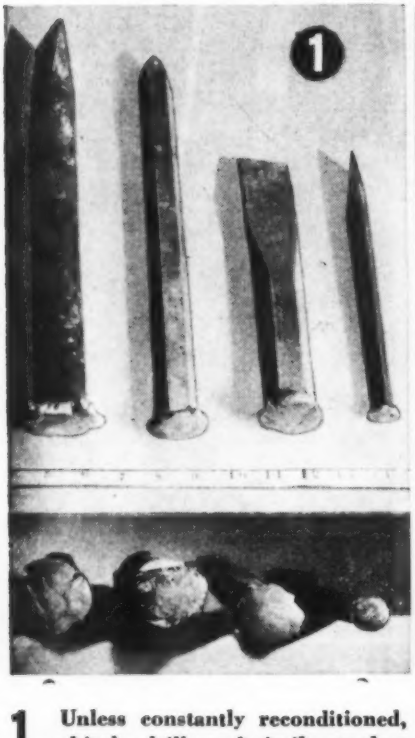
HOW TO RECONDITION YOUR BATTERED TOOLS

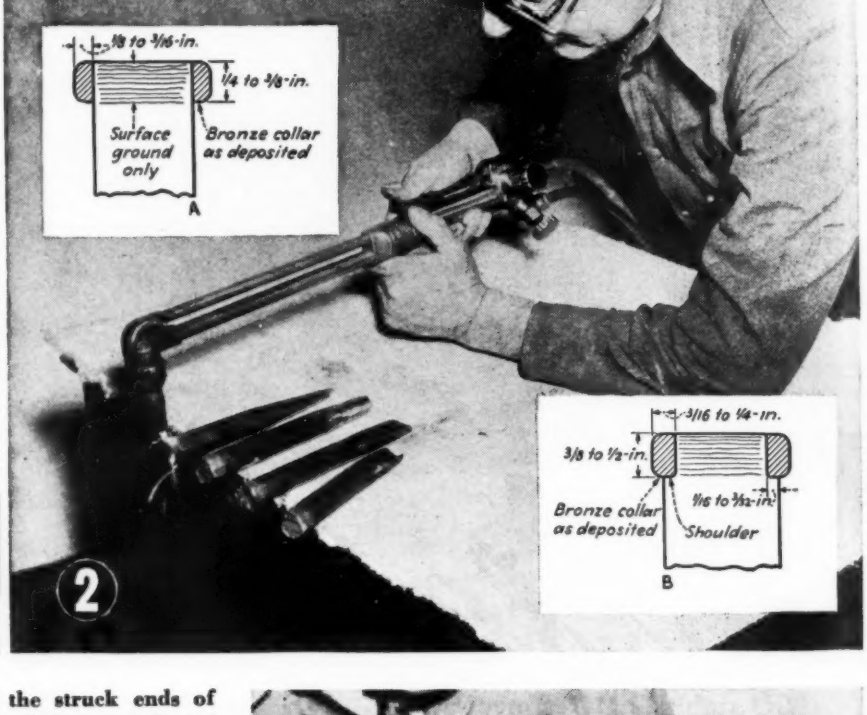
BRIEFLY, the entire safe-ending procedure consists of preparing the tool end, depositing a collar of bronze and grinding to finished shape.

Procedure is simple, quick and economical, and may be repeated as often as necessary. Used for chisels, punches, wedges and other hammerstruck tools, it is equally applicable to old and new implements.

Amount of preparation depends upon the tool's condition. If new, preparation consists merely of grinding the end. As in all bronze welding or surfacing, it is important to obtain complete tinning between the bronze and base metal in order to secure a strong bond.

Courtesy of The Linde Air Products Co.



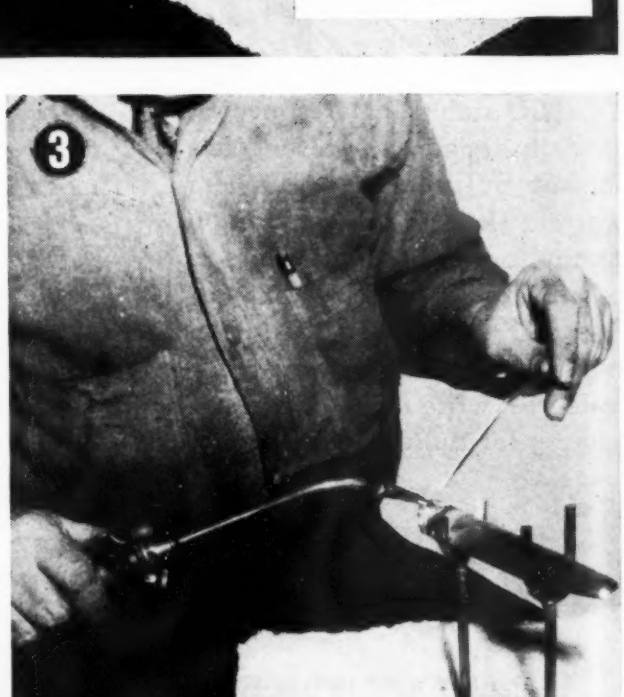


1 Unless constantly reconditioned, the struck ends of chisels, drills and similar tools mushroom, crack and spall long before the working end wears out. Impact from hammer blows may send a mushroomed piece flying and cause painful and serious injury to workmen.

2 Prepare used tools by removing the damaged metal with a cutting torch. Then grind the area to be welded to remove rust, scale and other foreign matter so that metal bonds completely. When the properly cleaned tool end is heated and fluxed, the bronze spreads out in a thin film to "tin" the base. Good tinning gives a firm bond. For heavy tools, a shoulder (B) backs up the bronze.

3 Around the ground area, put a layer of No. 25 M bronze, ¼ to ⅜ in. wide and ⅛ to 3/16 in. deep, (2A) depending on the tool's size. Welding operation produces no change in hardness of the tool end when bronze-welded properly. Proper base-metal temperature is from 1600 to 1700 F, indicated by a faint red when viewed through welding goggles in the light from oxyacetylene flame.

Use a small flame and speed up welding near the finish. Heat builds up as operator encircles the tool so that less is needed near the finish. Change in tool hardness can be corrected after welding is completed.



WHY MR. TATE IS WORKING LATE

It's neither a new or very difficult problem that's keeping Mr. Tate around after hours. Just a little matter of scale in a pressure regulator.

But it could have been avoided easily. Simple, inexpensive, yet highly effective, an Edward forged steel strainer would have done the trick.

It's economical preventive maintenance to protect the delicately adjusted working parts of your traps, pumps, pressure regulators, air motors and valves with Edward strainers. In plants all over the country Edward strainers are preventing unnecessary shut-downs that cost money and keep operating and maintenance personnel on overtime hours.

FUNCTIONAL DESIGN MAKES CLEANING EASY

There are only a few, functionally designed working parts in Edward strainers. Extremely easy to clean, they may be blown out simply by removing the drain plug, or they may be disassembled quickly with ordinary tools to remove and clean the Monel strainer screen. For steam, oil or vapor service up to 600 lb at 850 F or hydraulic service up to 1440 lb at 100 F. Screwed or socket welding ends, sizes ¼ in. to 2 in.

AVOID UNNECESSARY SHUT-DOWNS—Protect traps, pumps, regulators, air motors, meters, and valves with EDWARD STRAINERS.

FOR HORIZONTAL OR VERTICAL LINES

Strong, simple, versatile Edward forged steel strainers may be installed in either horizontal or vertical lines with equal effectiveness.

1. MONEL SCREEN

Rustproof Monel metal perforated screen, fit for severe abrasive service. Careful fitting prevents leakage of foreign matter around or under screen.

2. FORGED STEEL BODY

Streamlined internal body contours cut pressure drop to its minimum and promote free flow.

3. BONNET ASSEMBLY

Steel union ring and bonnet hold screen firmly in place. Drain plug easily removed for cleaning out foreign matter.

THE EDWARD VALVE & MFG. CO., INC. • EAST CHICAGO, INDIANA

EDWARD *Steel* VALVES

CAST AND FORGED

THE ARGUMENT CORNER

Oswego Steam Station Zoo

Here is our zoo of several dozen "power" animals—living together in harmony. They're not for exhibition only, but are performing useful chores:

Slag MONKEYS	ELEPHANT'S trunk
SNAKE wire	FROG joints
Lathe DOGS	FISH plates
CAT walks	Electric MOUSE
CROW bars	HOG jet throttle
HORSE power	CLAM shell bucket
FLY ash	CHIPMUNK crusher
WORM gears	CATERPILLAR tractor
PONY express	SQUIRREL cage motor
BULL dozers	PIGS: Lineman's rubber

Transmission LIONS (two of the world's largest)

In our backyard (Lake Ontario) we have gulls, a few ducks and sometimes an eagle. The screen house has served as aquarium for a vast number of fish, and there is one courageous honest-to-goodness rat in the storeroom.

Oswego, N. Y. MARTHA B WALSH

Three Viewpoints

ENTIRELY DIFFERENT TYPES OF MIND may be useful in operating a plant. They may be personified as Practical Engineer, Efficiency Man and Bookkeeper.

The obsession of the Practical Engineer is to keep things in repair and running. He can repair equipment with his own hands. He knows intimately the various types of apparatus in his charge, knows where trouble is likely to develop and anticipates it. He keeps a large stock of tools and spare parts. Well before breakdown threatens, he overhauls. Things in his charge are always in order. In addition, he can handle labor.

But although the Practical Engineer knows that his plant is operating continuously and is delivering the service required, he does not know exactly what is going on, or just how much better performance might conceivably be had. This is the concern of the Efficiency Man, who would fill the plant with instruments, the office with records, and his own time with elaborate calculations, to the end that each part of the plant should testify definitely what it is doing, and the possibility of more efficient operation become apparent.

There remains the Bookkeeper, whose acts are conditioned by debits and credits. He performs the useful service of restraining the Practical Engineer and the Efficiency Man from turning the plant into a personal paradise, and he goes further. Under the persuasive slogan, "No expenditure without justification," he keeps the plant at just that state of wretchedness that the unwisdom of further neglect would be impossible of concealment, even by a Bookkeeper. Few tools, no spare parts, patching instead of overhauling, no money spent today on equipment that will run past midnight into tomorrow—these, with unenthusiastic personnel, distinguish the plant controlled by a Bookkeeper.

Easton, Pa. ERNEST M FERNALD

Nation's True Wealth

GEORGE EDWARD'S EDITORIAL, "Watchword: Economy," in May POWER, brings additional light on a subject that has had too little attention.

I know what you mean and, like you, have been surprised by the attitude of men responsible for costs. I used to blow glass for a "tight" old Hollander, at a pretty good hourly rate, and often noticed his look of contempt when I did not stoop to pick up a small cork used in the work—we had plenty of corks. But recently there was a time when corks were scarce, and I often thought of the old Hollander and wondered if after all he wasn't right.

Our whole economic system, and our social system, too, is built so strongly around the dollar that I wonder if some day we won't be in danger of conquest by a country more interested in conserving the true wealth of a nation—its natural resources.

It *costs* too much to reclaim scrap iron from junk cars. It *costs* too much to dig up old street car rails. It costs too much to save that wire on those switch leads. It *costs* too much to pay a man to save and sort waste paper. It *costs* too much to save a dropped nail or cork. I wonder . . .

Lima, O. HENRY M. MILES.

Gives Two Main Causes

ANSWERING ANL's inquiry (Readers' Problems, May POWER) low-water level in the middle drum can come from two causes. This section is either producing the most steam or its feedwater supply is restricted. We must assume the water-level indications are correct and that no serious water leaks are present.

Higher steam production comes from higher heat absorption either because of concentrated heat release, better baffling or more tubes affected by radiant heat. Bad slag accumulations on the remaining units, damaged baffles or few tubes exposed to radiant heat cause sluggish performance.

Feedwater flow to this drum may be restricted by an improperly adjusted regulator or scaled piping. If one regulator feeds all three drums,

(*Continued on page* 166)

POWER (magazine) Shortage — What to Do About It

Because paper is critically short, POWER's circulation is unavoidably frozen at present levels. That's why over 2000 engineers who want to subscribe today cannot be served—are on the waiting list. Established subscribers coming up for renewal don't have to wait if they get their orders in promptly, but some have let their subscriptions lapse and have thereby lost their priority. When that happens, it takes from one to three months to get back on the lists—and generally there is no way to buy, borrow, beg or steal the numbers missed.

To insure unbroken service and to protect yourself from inconvenience, the editors urge you to renew promptly on receipt of first notice. Sorry—it's war!

Safeguarding electrical cables on this KELLER MACHINE

Photo courtesy of Pratt & Whitney—Division Niles-Bement-Pond Co.

This is a famous Keller Machine under construction.

It is widely used to make the numerous master dies so important in American production. In peacetime, dies produced by this machine perform such amazing tasks as stamping out entire automobile tops in one fell swoop. Now these machines are doing equally astounding war production jobs by making intricate parts direct from a master sample.

The electrical system motivating this Keller Machine must be constantly protected from abrasion and the deteriorating effects of oil and grease. Little wonder that the power and control cables are covered with American Flexible Metal Hose, which flexes so easily it permits full freedom of motion.

In many other ways, also, American Flexible Metal Hose and Tubing serve the war industries with distinction; some by conveying oil, steam, gas and water; others as a vacuum service for removing filings and dust, and in a thousand and one other important applications.

43204

ANACONDA

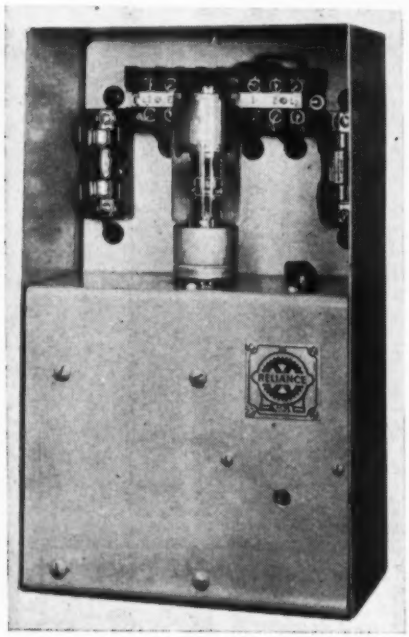
American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS, LTD., *New Toronto, Ontario*

What's New in Plant Equipment

Electronic Exciter Unit

NEW ELECTRONIC UNIT supplies excitation to all-electric adjustable-speed variable-voltage drives. These units are self-contained within their own wall mounting cabinets, or they can be added directly on control panel along with necessary contactors in the variable-voltage control. It is then only necessary to select proper-sized units for amount of excitation for each job. They can be added without any special



mounting bases or adapter rings, thereby making unit completely flexible over its size range. Exciter is for variable-voltage drives from 1 to 15 hp. It is a full-wave rectifier using an xenon-filled electron tube, having capacity of either 275 or 460 watt at 230 v. A 30-sec time switch delays load application until tube warms up. Selector switch permits matching of exciter to high or low plant voltages. Unit is fuse protected. *Reliance Electric & Engrg Co, Cleveland, Ohio.*

Turbine Generator

BUILT FOR WAR SERVICE, new auxiliary power unit meets U. S. Navy requirements and Maritime Commission Standardized Specifications. Basic design range is wide, starting at 250 kw. Turbine is said to have an economical water rate per kwhr, thus insuring low operating cost. Turbine backbone is large-diameter spindle with disks having large hub sections. Steel Rateau nozzle disks have welded-in, rolled stainless-steel nozzle blades and spacers. Governing system has antifriction bearings and is without stuffing boxes or soft packings. Reduction-gear case is of fabricated steel.

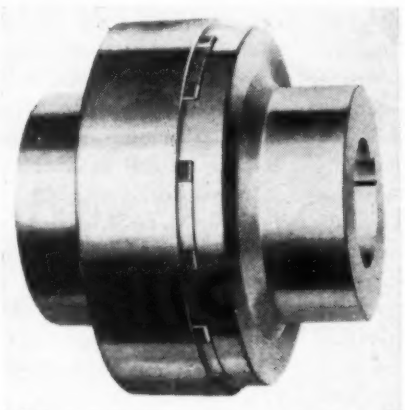
Rigidity is combined with lightweight. External piping is reduced to a minimum. Shockproof generator field yoke is of rolled steel plate, split on the horizontal centerline with halves bolted together. Dimensions are said to provide for emergency overloads, maintaining high efficiency throughout. Shaft bearing is sleeve design, mounted in a self-aligning spherical seat. *Joshua Hendy Iron Works, Sunnyvale, Calif.*

Frequency Meter

EIGHT RANGES OF NORELCO direct-reading frequency meter cover 0 to 50,000 cycles. Sufficient power is available to operate a strip-chart recorder without an auxiliary amplifier. Accuracy is held to close limits, even though audio voltage varies between 2 and 200 v. *North American Philips Co, 100 E 42nd St, New York 17, N. Y.*

Shrouded Flexible Coupling

L-R TYPE C shrouded flexible coupling protects operator. Outside steel collar holds load cushion in place, and has an extension which encircles the coupling, safeguards material and fingers from bolt heads that secure load cushion retainer. Boltheads are concealed, but are easily reached. Type C noiseless couplings are



for heavy-duty services from 4.60 to 806 hp at 100 rpm. Models are available for direct attaching to flywheel, also drum models and others for rapid disassembly without disturbing drive or driven equipment, etc.

Cushions of various materials, adapted to the particular service on which the coupling is used, are always in sight. In operation, half the cushions are idlers (except on reversing load). A new set is therefore always ready. No lubrication is required. *Lovejoy Flexible Coupling Co, 5009 W Lake St, Chicago 44, Ill.*

Rotary Pumps

DOUBLE HELICAL OR HERRINGBONE gear pumps handle liquids with inherent lubricating qualities. Ten sizes range from a ½-in. suction and discharge, with a capacity of from 1 to 1½ gpm, to the 2½-in. design, with capacity ranging from 50 to 75 gpm. All sizes have maximum working pressure of 75 psi, and are for direct drive through flexible coupling or for belt drive.

New rotary pumps feature simple construction, involving but two moving parts, a split-bolted gland, renewable bearings and built-in relief valve. *Goulds Pumps, Inc, Seneca Falls, N. Y.*

Above: Complete unit. Right: Cross-section showing header and inner tube construction

Heavy-Duty Heater

STURTEVANT HEAVY-DUTY steel heaters are of 1-in. standard steel pipe threaded into cast-iron headers; ¾-in. inner steel pipes carry steam from header, distribute it uniformly to all heater pipes, prevent air binding and provide a non-freeze characteristic, according to manufacturer. Wound around heater pipes are spiral fins, whose tapered construction is said to provide greater heat transfer than does the usual fin of uniform thickness. Four sizes, 20- 25- 30- and 35-in. width across pipes, each of which is furnished in lengths from 2 to 10 ft in 6-in. increments. *B. F. Sturtevant Co, Hyde Park, Boston, Mass.*

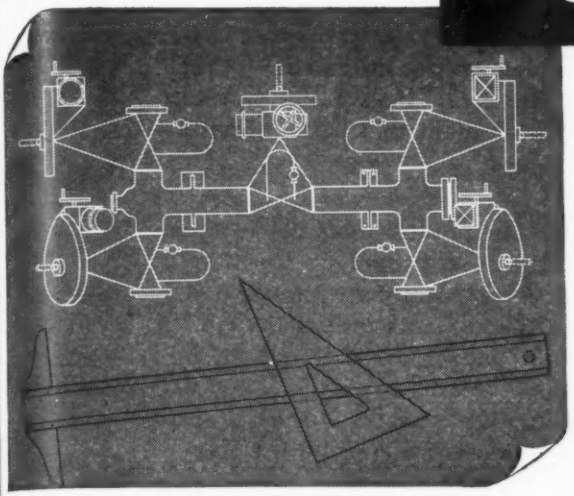
Turbine-Rotor Purifier

USING PRINCIPLE of centrifugal force, unit is said to trap moisture, oil and scale so that only purified air passes through compressed air system to discharge point. Air entering *Pur-O-fier* from intake pipe rotates a high-speed rotor, which is sensitive to velocity. Rotor beats atomized moisture and vaporized oil into larger particles, which are driven outward and downward by a shroud. As they are cooled, entrainments are drained by gravity into a reservoir designed for manual operation. Units with automatic draining are also available. Openings at shroud top dis-

(*Continued on page* 136)

Shop-Fabricated Assemblies . . A Complete Service from CRANE

1. ON THE DRAWING BOARD — *No matter how complex your piping assembly design may be, all parts—valves, fittings, and pipe—are supplied by Crane. One source of supply—one order covers everything.*



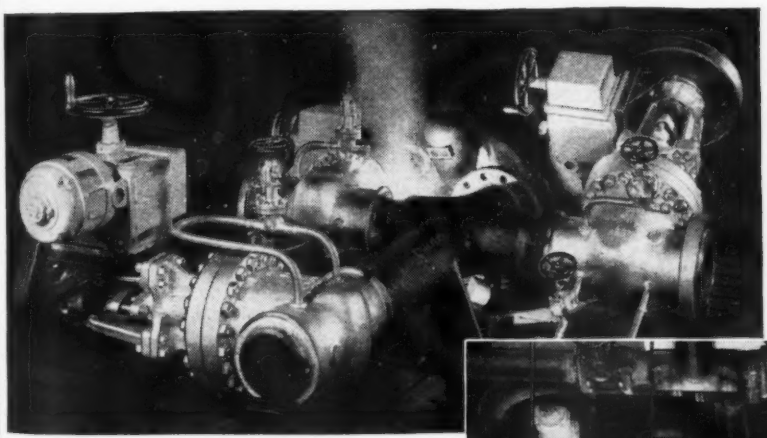
SHOP-FABRICATION typifies Crane complete service in the highest degree. Your blueprint in Crane Pipe Shops means delivery to your installation of a unit meeting every intent of design. For at Crane, no job is too small—none too large or complex—and absolute adherence to specifications is a matter of pride.

As the world's leading supplier of valves, fittings, and fabricated piping, Crane Co. produces all types of header assemblies of valves and fittings. Completely shop-welded, stress-relieved and tested, and conforming fully to code requirements, such Crane-built units—whether for power or processing systems, high or low pressure—stand out as the finest combinations of materials and workmanship.

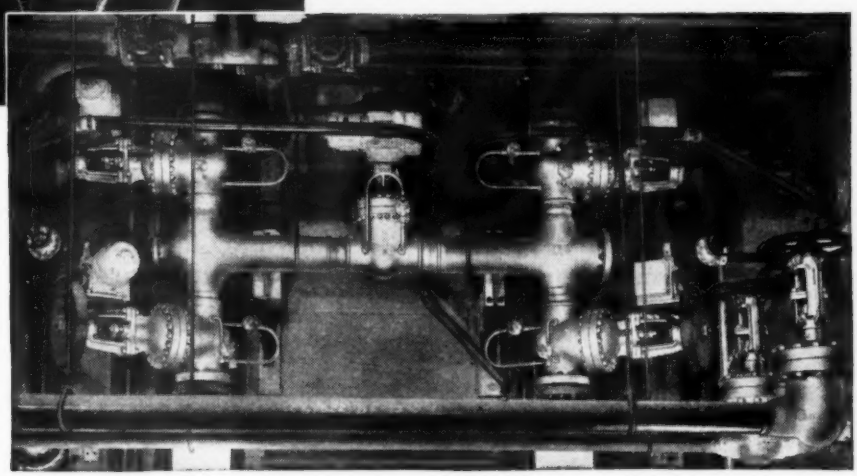
The same rigid control applied in making Crane valves and fittings marks every pipe shop operation. From raw materials to finished assemblies, one high standard of quality is maintained by the most elaborate facilities in the industry. Your complete satisfaction with every job is assured by Crane Co.'s 89-year leadership in the piping equipment field.

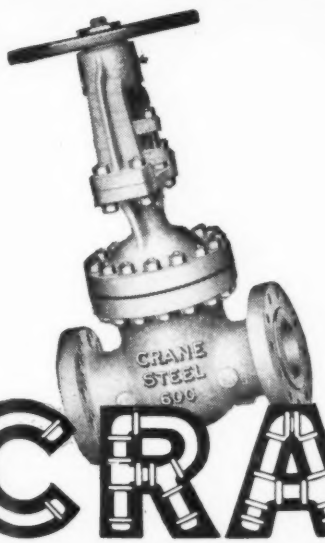
Crane Co., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*

2. IN THE FABRICATING SHOP — *All designs are completely fabricated by Crane. Proper selection of all parts is assured by the complete Crane line. One responsibility covers all materials and workmanship.*



3. ON THE JOB—*With Crane materials and Crane craftsmanship in every part, one standard of quality guards the entire assembly. Shown is the completed 12 x 8 x 4 in. header assembly of 600-pound cast steel motor-operated gate valves and fittings, installed in a central station.*





CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

Tomorrow's Training . . . . .

Returning soldiers tell how people of other countries still believe that Americans are either Indians, gangsters or idle rich. Hollywood movies did that for us, proving again Confucius' old statement that "One picture is worth a thousand words."

But the Services have taken a leaf from the movies' book. They've used pictures, models, charts, diagrams and films in preparing the best-trained fighting men who have ever gone into action. War plants, too, have tossed out time-worn methods to meet the unprecedented demand for production, with working forces composed largely of the unskilled. They train a riveter in eight days, an assembler in a few hours, even a machine operator in a week. They do it with models, charts, and pictures, by replacing the old reliable three-view mechanical drawing with a perspective sketch, by breaking complex jobs down into simple elements.

In doing all this, however, we have developed a new standard for education. Returning soldiers are going to expect similar high-speed instruction to re-orient them for peacetime jobs. And there is no real reason why they shouldn't have it.

The fundamentals are simple—it merely means more thought on the part of the teacher or employer. More time spent in preparing to teach will save tremendous amounts in teaching. For example, in one recent case, I spent half a day studying a complex blueprint and making a rough perspective sketch of the assembly it showed. A draftsman spent a day converting my rough sketch into a shaded drawing. But now anyone can understand the operation of the assembly with only a few minutes of study.

The principle of simplification goes far beyond the problem of training a new man. Manufacturers can tremendously increase acceptance and understanding of their products by preparing bulletins and catalogs with such illustrations. Technical magazines can do it—as POWER did in its June Diesel Injection special section. Such material is not intended for the raw recruit but for the trained man. It still, however, gives much better results because it guarantees maximum return to the reader for the time invested. The same thing holds for the many excellent movies now available from equipment manufacturers. They show how products perform in service—and are far more convincing than words or testimonial letters. Yes, Confucius, two thousand years ago, had something very practical.

George Edwards
Engineer

Because the yarn is Interlocked and braided square

THIS ROD PACKING CAN'T UNRAVEL OR COME APART!

THE BRAIDING of the asbestos yarn in Johns-Manville Interlocked Rod Packing is done in a unique and exclusive way. Instead of braiding jacket over jacket, which unravels with wear, the long-fiber asbestos yarn is braided right into the body of the packing and securely interlocked to form a solid, integral structure. Naturally, this means longer packing life and fewer repacking jobs for you!

Furthermore, J-M Interlocked Rod Packing is braided square . . . not braided round and pressed square . . . resulting in a more flexible and resilient packing. This square-section structure presents a better contacting area and provides a tight seal with minimum gland pressure.

J-M Interlocked is now available in a variety of compositions to meet a wide range of operating conditions—such as Nos. 255 and 257 for use against saturated or superheated steam, hot or cold, fresh or salt water, oils and weak caustics or acids, No. 253 for paper stock pumps, No. 259 for gasoline service, and No. 270 for hot oil packing. For more details, write for catalog PK-12A. Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

THERE'S A J-M DISTRIBUTOR NEAR YOU

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N. Y. State NAPE Holds 49th Annual Meeting

At the Prospect House, Niagara Falls, N. Y., New York State Assn, National Assn of Power Engineers, held its 49th annual meeting and conference, June 9 and 10, with about 75 delegates and guests attending. In the photo below, arrow points to Frank Smart, chief engineer, Beth Israel Hospital, New York City, who was elected president for the year 1944–45.

Included in the successful program were the following subjects: Conservation of fuel; State educational program for power engineers; Power engineers Aid-to-War program; Postwar plans for power engineers; Rehabilitation and placement of discharged war veterans; State legislation for licensing of power engineers.

At the technical sessions, Igor J Karassik, application engineer, Worthington Pump & Machinery Corp, spoke on boiler-feed pumps, and how to get from them the service for which they were designed. Dr Wm Parche, consulting engineer, told what qualities are found in a good grease, how to select the proper grease for a specific application and how to apply it.

Officers elected were: president, Frank Smart, Bronxville, N. Y.; vice-president, J H Taylor, Niagara Falls; secretary, F W Savage, Buffalo; treasurer, James Black, Albany; conductor, A Carter, Buffalo; doorkeeper, E A Hamilton, Syracuse; chaplain, Jesse

(*Continued on Page* 180)

AN APPRECIATION OF GEORGE ORROK

DAVID MOFFAT MYERS
CONSULTING ENGINEER
21 EAST 40TH STREET
NEW YORK 16

ASSOCIATES
GEO. A. ORROK
OSBORN MONNETT

June 20, 1944

Mr. Philip W. Swain, Editor
POWER
330 West 42nd Street
New York 18, N. Y.

Dear Phil:

Thirteen years of intimate association with Geo. A. Orrok, engineer, have been an experience of rich and lasting value. My appreciation and gratitude for those years, so full of professional inspiration and warmest friendship, can only be exceeded by my daily sense of loss in the passing of "Uncle George."

To have enjoyed this long period of closest association with an engineer of his international reputation and high and generous character, was indeed a rare privilege, and one never to be forgotten.

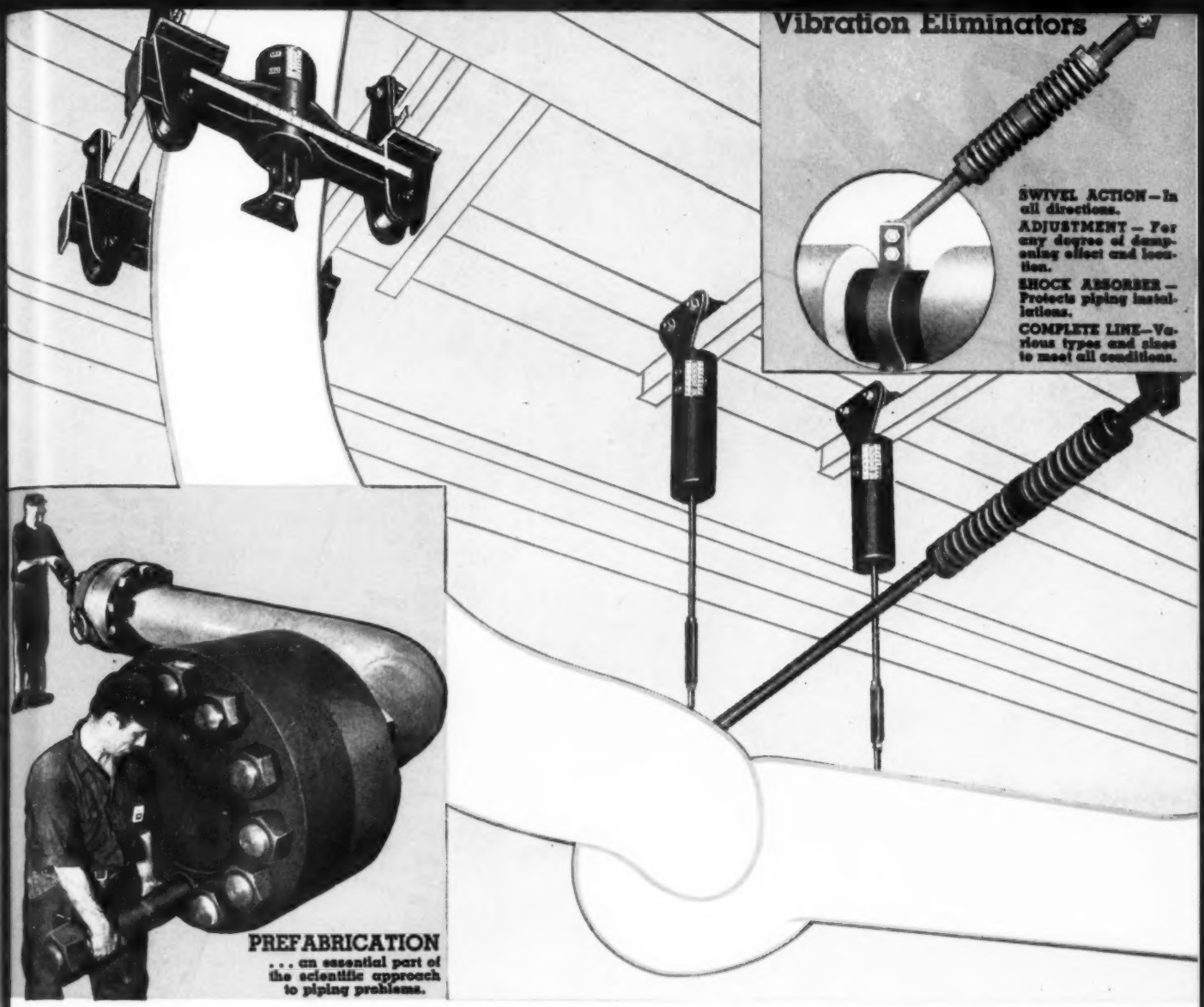
Much has been published regarding his professional life, and his record of extensive and versatile accomplishment There has been not the slightest exaggeration in any of these accounts, which are a source of pride to his astonishingly large number of friends and acquaintances in the many countries of the world where his work and personality were so favorably known.

I need add nothing to all of this, but as his professional associate and close friend, I desire publicly, to express my admiration and respect for Geo. A. Orrok and to contribute these few words in honor of a great engineer, a true gentleman, and a very dear friend.

DAVID MOFFAT MYERS

George A Orrok, internationally known consulting engineer, died in April at the age of 77. His distinguished career was reviewed in June POWER. Because "Uncle George" was truly a great man, as well as a pioneer power engineer, the editors welcome this opportunity to publish a personal letter of appreciation from his long-time professional associate, David Moffat Myers, consulting engineer.

National Assn of Power Engineers, New York State Assn, at its 49th meeting. Arrow points to President Frank Smart


Vibration Eliminators
SWIVEL ACTION—In all directions.
ADJUSTMENT—For any degree of dampening effect and location.
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COMPLETE LINE—Various types and sizes to meet all conditions.
PREFABRICATION
. . . an essential part of the scientific approach to piping problems.

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Specify Functional Hangers and Vibration Eliminators

They make possible the installation of the most economical shaped structures by permitting free flexure of the entire piping system in all planes. Spring assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a neat "professional" appearance.

Power Piping Functional Hangers are saving thousands of man hours in design, fabrication, and erection. They are of standardized design and fit all needs . . . marine . . . power.

These two books constitute a service offered by Power Piping Division for the benefit of the engineering fraternity and will be sent FREE to any engineer requesting them on his business letterhead.

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War Report

MERGENTHALER LINOTYPE COMPANY
BROOKLYN, NEW YORK
Executive Offices and Factory: Park Avenue and Ryerson Street
Telephone: Evergreen 7-0300

June 12, 1944

Awarded to Linotype
"FOR HIGH ACHIEVEMENT
IN THE PRODUCTION OF
WAR EQUIPMENT"

Jenkins Bros.
80 White St.
New York 13, N.Y.

Gentlemen:

Thanks very much for the folders about valve care. They will be most helpful to our maintenance crew.

As you know, we have been using Jenkins Valves for over 30 years, and a number of years ago we decided to standardize on Jenkins for our plants. Our experience with them during this war has more than justified our decision.

With the plant working around the clock and maintenance often much less than it should be, our valves, along with other equipment, have taken an unheard-of beating, but they have more than met the test.

We are glad to say that we have not lost any production time as a result of valve failure — a good thing, too, because our schedule for production of Fire Control Instruments permitted no lost time.

Very truly yours,
MERGENTHALER LINOTYPE COMPANY

O. F. Maehr, Plant Engineer

OFM:db

JENKINS VALVES

SINCE 1864

from the Arms Production Front

...cites proof that Jenkins Valves cost least in the long run

The record of Jenkins Valve performance, under the toughest conditions of wartime plant operations, is beginning to come in from busy plants like the Mergenthaler Linotype Company.

This company has had a major part in the production program of Fire Control Instruments for our armed forces. Since Pearl Harbor their equipment has been subjected to the equal of 7 years of normal stress and wear. Also, there has been little time and too few trained workers for normal inspection and maintenance.

No other test could so clearly demonstrate the built-in endurance of every Jenkins Valve – a direct result of better materials, better workmanship, and better design.

War records like this, reported by Mergenthaler, world's largest builder of typesetting machines, and other plants of America's biggest industries, repeat the many peacetime records of Jenkins Valves – and all add up to convincing proof of their "lowest cost in the long run".

In your plans for reconversion and renovation, it will pay you to specify *Jenkins* for every bronze, iron and steel valve requirement.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London.

PUT THIS MAN ON YOUR POST-WAR PLANNING BOARD

Your Jenkins Distributor has a complete picture of the valve supply situation at all times. He can keep you informed about valves available, aid you in selection, and provide the help of Jenkins Engineering Service for special problems.

His distinguished service to war industry, often in the face of baffling supply conditions, has prepared him even better than ever to give you the help you'll need for re-conversion.

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

BRONZE · IRON · STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

POWER'S DATA SHEETS

Number 144

Temperature-Superheat Table for Throttling Steam—I

▶ THIS CONVENIENT TABLE lists final temperature and degrees of superheat for steam that is throttled from one pressure to another lower pressure without appreciable addition or loss of heat. For example, steam at 265-psi absolute pressure and 411 F will have 1205 Btu per lb enthalpy, according to Keenan and Keyes steam tables (John Wiley & Sons, 1936 edition). If throttled to 16 psi abs (read vertically downward in the 1205 Btu per lb column) the final temperature will be 328 F and the degrees of superheat (in light-face type) will be 112 F.

Pressure abs, psi	*Steam temp sat, F*	*Total heat, Btu per lb*	*Enthalpy — Btu per lb*																				
			1155	1160	1165	1170	1175	1180	1185	1190	1195	1200	1205	1210	1215	1220	1225	1230	1235	1240	1245	1250
265	406	1201.2	*5.6*	*5.0*	*4.4*	*3.8*	*3.2*	*2.6*	*2.0*	*1.3*	*0.8*	*0.2*	5 411	13 419	20 426	27 433	35 441	43 449	51 457	59 465	67 473	76 482
255	403	1200.8	*5.5*	*5.0*	*4.4*	*3.7*	*3.1*	*2.5*	*2.0*	*1.3*	*0.8*	*0.1*	6 409	13 416	20 423	28 431	36 439	44 447	52 455	60 463	68 471	77 480
245	400	1200.4	*5.4*	*4.9*	*4.3*	*3.6*	*3.1*	*2.4*	*1.9*	*1.2*	*0.7*	*0.1*	6 406	13 413	21 421	28 428	36 436	44 444	52 452	61 461	69 469	78 478
235	396	1199.9	*5.3*	*4.8*	*4.2*	*3.5*	*3.0*	*2.4*	*1.9*	*1.2*	*0.6*	*0.1*	7 403	15 411	22 418	30 426	38 434	46 442	54 450	62 458	71 467	80 476
225	392	1199.3	*5.2*	*4.7*	*4.1*	*3.4*	*2.9*	*2.3*	*1.8*	*1.1*	*0.5*	1 393	8 400	16 408	23 415	31 423	39 431	47 439	56 448	64 456	73 465	81 473
215	388	1198.8	*5.1*	*4.6*	*4.0*	*3.4*	*2.8*	*2.2*	*1.7*	*1.0*	*0.4*	4 392	10 398	17 405	25 413	32 420	41 429	49 437	57 445	66 454	74 462	83 471
205	384	1198.1	*5.1*	*4.5*	*3.9*	*3.3*	*2.7*	*2.1*	*1.6*	*1.0*	*0.3*	3 387	10 394	18 402	26 410	34 418	42 426	50 434	59 443	67 451	76 460	85 469
195	380	1197.5	*5.0*	*4.4*	*3.8*	*3.2*	*2.6*	*2.0*	*1.5*	*0.8*	*0.3*	4 384	11 391	19 399	27 407	35 415	43 423	52 432	60 440	69 449	78 458	87 467
185	376	1196.8	*4.8*	*4.3*	*3.7*	*3.1*	*2.5*	*2.0*	*1.4*	*0.7*	*0.2*	5 381	12 388	20 396	28 404	36 412	45 421	53 429	62 438	71 447	80 456	88 464
175	371	1196.0	*4.7*	*4.2*	*3.6*	*3.0*	*2.4*	*1.9*	*1.3*	*0.6*	*0.1*	6 377	14 385	22 393	30 401	39 410	47 418	56 427	64 435	73 444	82 453	91 462
165	367	1195.1	*4.6*	*4.0*	*3.5*	*2.9*	*2.3*	*1.7*	*1.2*	*0.5*	*0.1*	7 374	15 382	23 390	31 398	40 407	48 415	57 424	66 433	75 442	84 451	93 460
155	362	1194.1	*4.5*	*3.9*	*3.3*	*2.8*	*2.1*	*1.6*	*1.0*	*0.4*	1 363	9 371	17 379	25 387	33 395	42 404	50 412	59 421	68 430	77 439	86 448	96 458
145	356	1193.1	*4.3*	*3.8*	*3.2*	*2.6*	*2.0*	*1.4*	*0.9*	*0.3*	3 359	11 367	19 375	28 384	36 392	45 401	54 410	63 419	72 428	81 437	90 446	99 455
135	351	1191.9	*4.2*	*3.6*	*3.0*	*2.5*	*1.9*	*1.3*	*0.7*	*0.2*	5 356	13 364	21 372	30 381	38 389	47 398	56 407	65 416	74 425	83 434	93 444	102 453
125	345	1190.6	*4.0*	*3.5*	*2.9*	*2.3*	*1.7*	*1.1*	*0.5*	*0.1*	7 352	15 360	24 369	32 377	41 386	50 395	59 404	68 413	77 422	87 432	96 441	106 451
115	339	1189.2	*3.8*	*3.3*	*2.7*	*2.1*	*1.6*	*1.0*	*0.4*	1 340	9 348	18 357	26 365	35 374	44 383	53 392	62 401	71 410	81 420	90 429	100 439	109 448
105	332	1187.6	*3.6*	*3.1*	*2.5*	*1.9*	*1.3*	*0.8*	*0.3*	4 336	12 344	21 353	30 362	39 371	48 380	57 389	65 397	76 408	85 417	95 427	104 436	114 446
95	325	1185.8	*3.5*	*2.9*	*2.3*	*1.7*	*1.1*	*0.6*	*0.1*	7 332	15 340	24 349	33 358	42 367	51 376	61 386	70 395	80 405	89 414	99 424	109 434	119 444
85	317	1183.8	*3.2*	*2.7*	*2.0*	*1.5*	*0.9*	*0.3*	2 319	11 328	19 336	28 345	37 354	47 364	56 373	66 383	75 392	85 402	95 412	104 421	114 431	124 441
75	309	1181.5	*2.9*	*2.5*	*1.8*	*1.3*	*0.6*	*0.1*	6 315	14 323	23 332	32 341	42 351	51 360	61 370	70 379	80 389	90 399	100 409	110 419	120 429	130 439
65	299	1178.8	*2.6*	*2.0*	*1.5*	*1.0*	*0.3*	2 301	11 310	20 319	29 328	39 338	48 347	58 357	67 366	77 376	87 386	97 396	107 406	117 416	127 426	138 437
55	288	1175.7	*2.3*	*1.7*	*1.2*	*0.5*	*0.1*	8 296	17 305	26 314	36 324	45 333	55 343	65 353	75 363	85 373	95 383	105 393	115 403	125 413	136 424	146 434
45	276	1171.9	*1.8*	*1.3*	*0.7*	*0.1*	5 281	15 291	24 300	34 310	44 320	53 329	63 339	73 349	84 360	94 370	104 380	114 390	124 400	135 411	145 421	155 431
35	261	1167.2	*1.3*	*0.7*	*0.2*	5 266	15 276	24 285	34 295	44 305	54 315	64 325	75 336	85 346	95 356	105 366	116 377	126 387	137 398	147 408	157 418	168 429
25	242	1161.0	*0.6*	*0.1*	8 250	18 260	28 270	38 280	48 290	59 301	69 311	79 321	90 332	100 342	111 353	121 363	132 374	142 384	153 395	163 405	173 415	184 426
20	228	1156.0	*0.1*	8 236	18 246	28 256	38 266	49 277	59 287	70 298	80 308	91 319	101 329	112 340	122 350	133 361	144 372	154 382	165 393	176 404	186 414	197 425
16	216	1151.8	7 223	17 233	27 243	38 254	48 264	59 275	69 285	80 296	91 307	101 317	112 328	123 339	133 349	144 360	155 371	165 381	176 392	187 403	197 413	208 424

Percent Moisture

Charles A Pohlig

ONLY *Flowmatic* OFFERS ALL THESE ADVANTAGES

Performance records confirm the Copes Flowmatic Regulator as the outstanding development in Boiler Feed Water Control.

Here's why--

Read the interesting 5-year performance record of Copes Flowmatic, summarized in the folder "No Two Boilers Are Alike." Furnished free, together with descriptive catalog, upon request for Bulletin 429A.

1. Copes Flowmatic varies the rate of feed in proportion to changes in steam flow, with secondary compensation from boiler water level.
2. Maintains boiler water level within extremely close limits—minimizes effect of "shrink" and "swell."
3. Eliminates danger of burned tubes due to low level, or carry-over due to high level.
4. Flowmatic saves fuel—decreases maintenance. Instant and correct response to every demand provides optimum feed conditions for boilers, economizers, heaters and pumps.
5. Increases boiler capacity; gives more uniform steam pressures.
6. Reduces tendency to swap loads among boilers of a battery.
7. Copes Flowmatic usually eliminates the necessity of differential pressure control.
8. Lower first cost and maintenance than other systems for similar service.
9. Can be installed, adjusted, and cut into service by plant personnel. Not dependent on factory specialists.
10. Adjustable for any desired water level characteristic—falling, constant, or rising with load.
11. Flowmatic is fully automatic and is independent of other control systems.
12. Thoroughly dependable, built for continued hard usage with no more than routine care and inspection.
13. Available in both direct operated and relay operated types.
14. Flowmatic is a Copes Product—symbol of pioneering and leadership in feed water regulation.

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841 GROVE DRIVE • ERIE, PA.

Feed Water Regulators • Pump Governors • Liquid Level Controls • Differential Valves • Reducing Valves and Desuperheaters

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COPES — FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

★ **GET CLOSER LEVEL CONTROL WITH THE FLOWMATIC**

★ REGULATOR

Coe Drainators are enlisted in the "War on Waste" because of their long established ability to serve faithfully and save consistently over long periods.

Drainators serve with maximum efficiency on steam using equipment by quickly and completely eliminating condensate, air and non-condensible gases.

Model M-41-S DRAINATOR

Adequate capacity is provided in the Model M-41-S Drainator to handle loads usually placed upon ½-inch traps. Typical Drainator performance is assured in this smaller, lower priced unit which has a magnetic operation indicator that can be installed on either side.

Drainators save steam, manhours, fittings and maintenance! Operating on an unvarying thermo-dynamic principle, they require no moving parts or complicated bypasses. Visible indication of continuous, efficient operation makes dismantling and frequent inspection unnecessary.

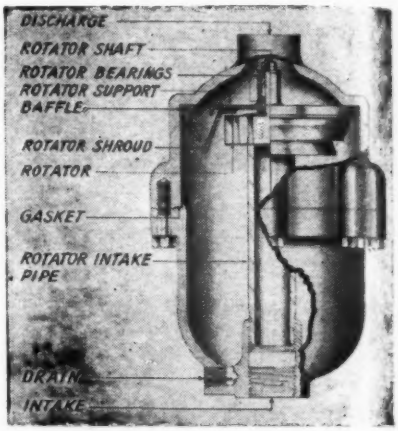
The COE MANUFACTURING Co.
501 BANK ST., PAINESVILLE, OHIO

DRAINATOR • THE ADVANCED STEAM TRAP

Write for a copy of Bulletin No. 903-A or ask us to send an engineer to discuss your condensate handling problems.

New Equipment

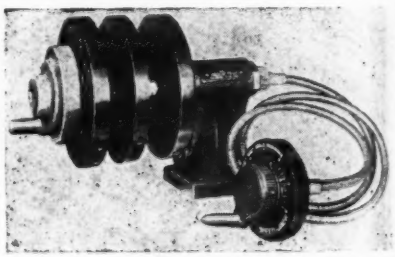
(*Continued from page* 126)



charge purified air. Model A-2, which has a 2-in. turbine rotor, accommodates volumes from 10 to 35 cu ft. Model A-4, with a 4-in. turbine rotor, accommodates from 35 to 100 cu ft. Multiple units are for volumes above this range. *Bird-White Co, 3119 W Lake St, Chicago, Ill.*

Variable-Speed Transmission

FEATURING SIMPLIFIED remote control and universal mounting, new variable-speed transmission has been developed for drives up to 1 hp. Easy remote control through a compact shaft makes it possible to mount unit anywhere *in* or *on* the machine and to place control in a safe location handy to operator. Because flange movement is controlled mechanically and not by belt pull *Speed-Jack* may be mounted vertically, horizontally or in any other position. *Speed-Jack* utilizes V-belts to provide step-



less control of speed through a 3:1 ratio. Control mechanism design eliminates ratio creep and assures constant belt alignment regardless of unit's mounted position, belt wear or stretch, according to maker. Plastic flanges, steel-faced for long service, contribute to lightweight and are said to provide accurate balance and smooth, silent vibration-free operation. *Dept 255, American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa.*

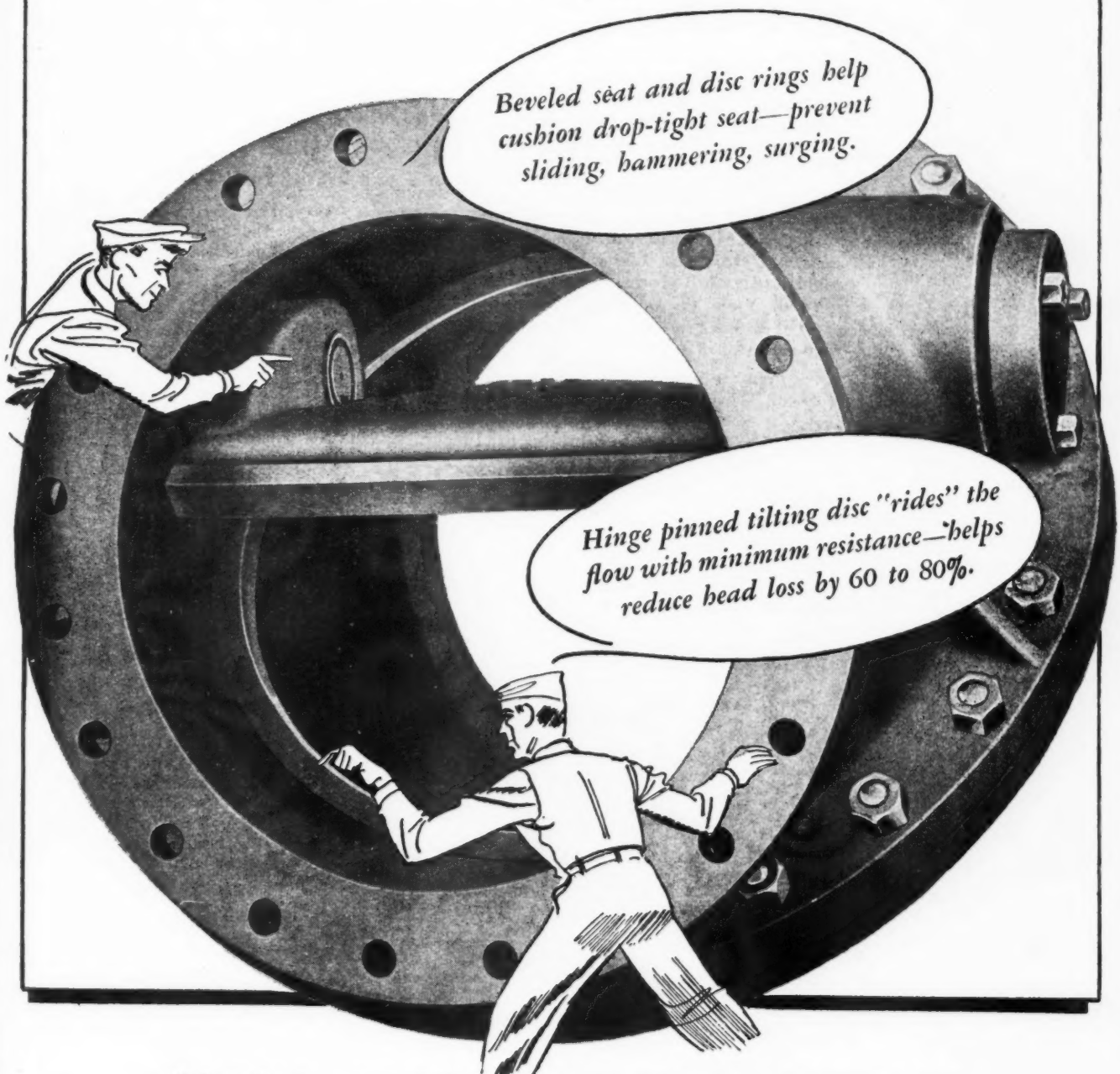
Direct-Fired Heater

FOR HEATING SMALL STRUCTURES and providing additional heat for limited areas, new model retains principal characteristics of regular line of Dravo direct-fired heaters but on a smaller scale. Over-all size has

LOOK WHAT

CHAPMAN'S AIRFOIL DESIGN

CAN DO FOR YOU!


Beveled seat and disc rings help cushion drop-tight seat—prevent sliding, hammering, surging.
Hinge pinned tilting disc "rides" the flow with minimum resistance—helps reduce head loss by 60 to 80%.

Write today for a copy of Chapman's illustrated Engineering Data Book. Gives you complete information on how Tilting-Disc Check Valves improve your plant operation and cut costs far beyond ordinary swing-type checks. The Chapman Valve Manufacturing Company, Indian Orchard, Massachusetts.

CHAPMAN NON-SLAM CUSHIONED CLOSING **CHECK VALVES**

Equally efficient on horizontal or vertical installations on water, steam, oil, gas and air lines

ALWAYS ON THE JOB

IN THE INTERESTS OF

FUEL CONSERVATION

The War Production Board says we've got to save 5,000,000 tons of coal this year. This gives steam plant owners a choice of two moves—either cut down on heating *or modernize for greater efficiency!*

Modernizing with Hoffman Steam Specialties is a proved way to get the same amount of heat from less fuel. Since 1913, the Hoffman Policeman trademark has symbolized fuel-saving efficiency.

It is a simple matter to restore run-down steam plants. By using Hoffman Traps, for example, to replace those units which are not giving satisfactory service, you are assured of full steam utilization and hence conservation of precious fuel. These traps have Thermostats made of non-corrosive metal, long-lived in spite of countless flexings and high temperatures.

Hoffman Traps are so constructed that all parts subject to wear can be easily and inexpensively renewed—no need to junk an entire unit because of a worn seat. Send today for literature on Hoffman Valves, Traps and Pumps . . . and remember that Hoffman engineers are always available for consultation on your heating problems.

Send today for this latest catalog of Hoffman Low, Medium and High Pressure Traps.

HOFFMAN 50 SERIES TRAP
Heavy duty unit with all working parts mounted on the cover.

HOFFMAN NO. 9 H TRAP
A bronze-bodied unit for pressures up to 125 lbs.

TESTED AT EVERY STEP

The rigorous inspections and tests applied to Hoffman Specialties are your warranty of satisfactory performance on the job.

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Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
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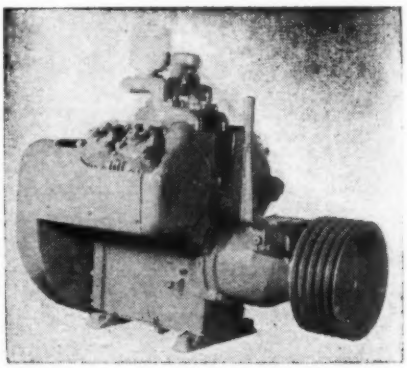
been reduced so that floor space requirements are 5¼x3 ft. It can be suspended from wall and equipped to burn either gas or oil. Oil burners may be quickly removed and gas burners and controls substituted, or vice versa, as conditions direct. Thermostatically-controlled heater requires a minimum of manual attention and may be obtained in capacities ranging from 300,000 to 850,000 Btu per hr. *Heater dept, machinery div, Dravo Corp, 300 Penn Ave, Pittsburgh, Pa.*

Folding Ladder

G HEAVY-DUTY lightweight ladder folds to 3x3-in. bundle. Special lock keeps ladder rigid in open position. Ladder, equipped with *Duo-Safety* shoes, is available in 6- to 20-ft lengths. *Duo-Safety Ladder Corp, Oshkosh, Wis.*

Gravity Feed Oiler

STREAMLINED OILER has a reinforced plastic reservoir that is said to be 50% lighter in weight than former models. Oiler has no gaskets and therefore leakage is eliminated. Dustproof oiler has a filter that can be removed without tools for cleaning. *Trico Fuse Mfg Co, Milwaukee, Wis.*



Air Compressor

STANDARD SCHRAMM MODEL 50 air compressor can be equipped with a self-contained clutch. This clutch makes Model 50 suitable for power takeoff or engine V-belt drive, or any application where compressor is to be disconnected from power source. *Schramm, Inc, West Chester, Pa.*

Mechanical Seal

DURA SEAL can be installed in pumps, agitators and other equipment having rotary shafts, provided there is no shaft end play. Seal may be made of many different materials and constructed to resist corrosion by almost any liquid, according to maker. *Durametallic Corp., Kalamazoo, Mich.*

Soot Valve

VALVE REMOVES SOOT and siftings from hoppers. Clearance between gates and valve bodies are adjustable, thus reducing air infiltration to a minimum. Valve opens and shuts easily under service conditions and is said to be dustproof, dripproof and stickproof. Soot valve is in 6- 8- 10- and

U N I F O R M

When a Tube-Turn welding fitting, be it an elbow, a tee, a return, or whatever type, is ready for shipment, it is *ready for good, long, hard service!* Every fitting must undergo rigid checks and inspections to insure uniformity of dimensions, of wall thickness at all points, of interior surface smoothness.

Tube Turns' exclusive manufacturing methods, plus constant vigilance in laboratory and plant inspection of materials and finished products, guarantee welding fittings that are *uniformly* sound, dependable and in accordance with all ASA., ASTM and other applicable standards. Write for Catalog 111.

New Dimensional Folder

Write for this convenient pocket-size folder containing condensed data on all Tube-Turn welding fittings and flanges.

SELECTED TUBE TURNS DISTRIBUTORS IN EVERY PRINCIPAL CITY ARE READY TO SERVE YOU WITH COMPLETE STOCKS.

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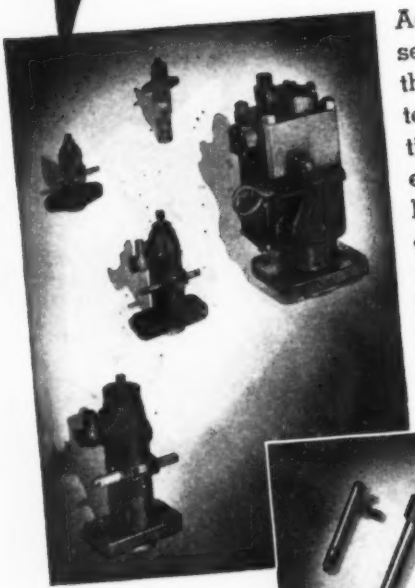
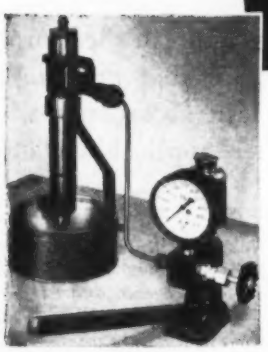
SAFEGUARD DIESEL ENGINE PERFORMANCE

with Dependable ADECO

FUEL INJECTION EQUIPMENT



Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.



ADECO NOZZLE TESTER
for LOW-COST MAINTENANCE

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

Ideal for Testing Hydraulic Equipment

ADECO

AIRCRAFT & DIESEL EQUIPMENT CORPORATION

4401 RAVENSWOOD AVENUE, CHICAGO 40, ILLINOIS

12-in. sizes. Square or round top and bottom flanges and either style OBC or 2BC may be furnished. *Stock Engrg Co, W 98th St and Theodore Ave, Cleveland 2, Ohio.*

Power Roof Ventilator

IRON LUNG, a power roof ventilator, which was changed from round to square design, removes fumes, gas, steam, smoke and excessive heat from buildings. It is said that regardless of wind direction or velocity, *Iron Lung* discharges impure air so high above roof that it cannot re-enter buildings through open windows, doors or idle ventilators. *Powermatic Ventilator Co, 4019 Prospect Ave, Cleveland 3, Ohio.*

Fire Extinguisher

INDUSTRIAL FIRE EXTINGUISHER is for extinguishing flammable liquids and electrical fires. Extinguisher ejects a stream of ALL-OUT dry chemical which, when activated by heat, is claimed to form a dense, fire-smothering cloud over an area up to 18 ft. ALL-OUT chemical, a non-conductor of electricity, is said to be harmless to humans and delicate, mechanized parts of motors or machinery. Extinguisher may be quickly recharged at fire without special recharging equipment. Extinguisher is easily handled by workers as it weighs only 37 lb fully charged. *National Powder Extinguisher Corp, 50 Rockefeller Plaza, New York.*

Insulating Varnish

R-851 INSULATING VARNISH is for applications that demand great lead wire flexibility in addition to high mechanical strength. Company states that R-851 shows so little progressive hardening when dried film is exposed to air that it is recommended for coating armature and stator coils that will be stored for long periods before assembly. Clear baking varnish is said to dry completely throughout when baked at a temperature of 135 C. Dried insulation is oil-proof and is water, acid and alkali resistant. It is particularly recommended for

NEW LIGHT ON AN OLD SUBJECT

Today's man-power and material shortages focus new attention on time-proved copper tubes for industrial piping. Copper tubes have always been a sound investment . . . they give long years of service with no need for down-time due to rust-caused repairs. Many busy war plants, equipped with pre-war installations of copper tubes, have maintained day and night operating schedules because no repairs have been necessary to their carrying lines.

Anaconda Copper Tubes offer many additional advantages: They are easily and economically installed with solder-type fittings . . . pumping costs are lower because their smooth interiors are less resistant to flow. They are rustproof . . . save space . . . bend easily. Copper tubes can be assembled quickly with soldered joints, thus providing a double economy in low labor and material costs.

In the event of changes in plant layout, copper tube lines may be disassembled and reinstalled with a minimum of expense.

Present use of copper tubes is drastically curtailed by war demands. But it will pay you to look ahead to the day when this worthwhile piping is again generally available. Publication C-24, sent on request, describes industrial applications of Anaconda Copper Tubes.

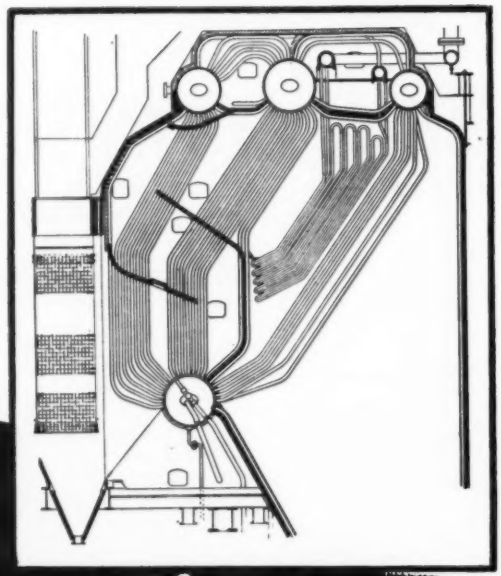
BUY WAR BONDS FOR VICTORY

ANACONDA

Anaconda Copper Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario



Streamlining
SAVES FUEL

MODERN methods of baffling boilers have reduced flue gas temperatures and draft losses, with a resulting increase in efficiency, capacity, economy of operation and ultimate saving of fuel.

Enco Streamline Baffles are built gas tight and at any angle across the tubes, or interbank spaces, in all water tube boilers. The construction provides for easy removal of tubes and is a life time job.

The long sweeping curves promote the smooth rapid flow of gases over practically every square foot of the heating surface — gas passes are tapered in correct proportion to the contraction of the gas as it cools to maintain gas velocity. Bottle necks, dead gas spaces and soot pockets are eliminated with resulting better heat-transfer and minimum draft-loss.

Flexibility in design and construction permits baffles to be placed in the most effective position instead of a convenient, location for easy installation.

Since boilers differ as to size and location of superheaters, number of drums, location of damper, nature of fuel, use of arches, water walls, etc., the design of an Enco baffle for each boiler is an engineering study which requires, and gets, individual study.

FREE BOILER BAFFLES

● *A bulletin on boiler baffles gives valuable information which every engineer should have. Ask for bulletin BW 44 It's free.*

THE ENGINEER COMPANY
75 WEST STREET • NEW YORK 6, N. Y.

Enco Streamline Baffles
PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY

electrical equipment wound with glass covered wire for operation at high operating temperatures. *Sterling Varnish Co,* 165 *Ohio River Blvd, Haysville, Pa.*

Splined Shaft Coupling

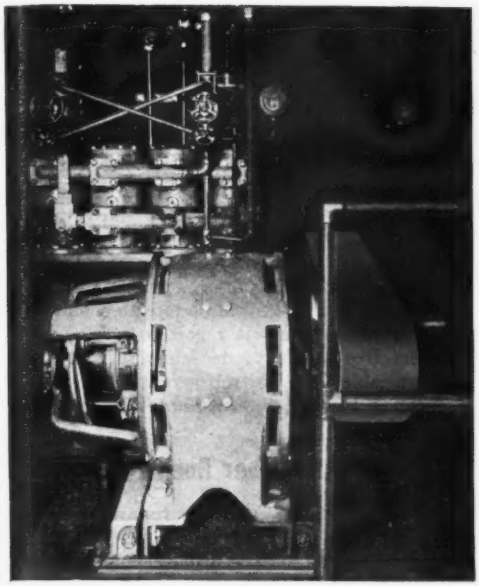
COUPLING STOPS TRANSMISSION of noise, absorbs shock and impact and compensates for misalignment between drive and driven shafting on a 75-hp engine-driven generator. Using synthetic as the insulating medium to permit operation in presence of lubricant, coupling consists of a splined inner sleeve, a flange and the synthetic separating bushing. This coupling is for operation at 6000 rpm, with a maximum torque of 788-in. lb. Design eliminates a separate flexible coupling. Same general design, with either keyway or splines, handles virtually any load by proper hardness and thickness of rubber or synthetic. *Bushings, Inc,* 3442 *W* 11 *Mile Rd, Berkley, Mich.*

Plastic Cord Trouble Lamps

PLASTIC CORDS are said to outlast rubber. Cords, of non-aging material, are waterproof and acid- oil- and alkali- resistant. Lamp has a cadmium-plated guard for bulb protection, as well as a metal reflector and swivel hanging hook. Safety push switch is recessed in heavy rubber grip handle. Cords are in 25-ft lengths. *Electric Cord Co,* 30 *Church St, New York.*

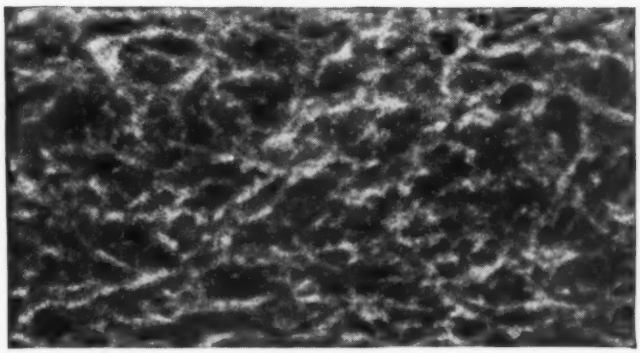
Insulated Terminal

TERMINAL CONNECTION for electrical wiring has its insulation bonded to terminal so that no insulation sleeving is required. Insulated terminal supplants conventional soldering methods. Press dies, or a simple hand tool resembling a pair of pliers, crimp terminal connection and wire it holds into a homogeneous mass. It is claimed tests have shown that this method produces uni-

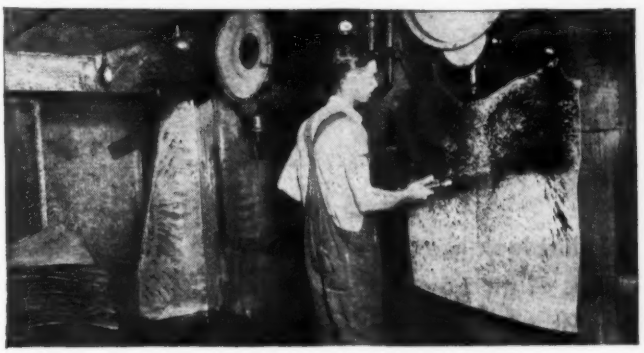


No substitute can equal THIS... for Least Maintenance

As an example of successful change-over to pivoted motor base with flat leather belt drive, this compressor, formerly chain-driven and now belted by a 10½" heavy double "Research" Leather Belt, is reported as operating "with all previous troubles eliminated." 40 H. P. motor, 850 R.P.M., 12" x 12" motor pulley (split fibre lagging over chain sprocket), 36" x 11" driven pulley.



Leather's fibres, interlaced in all directions, give leather belting *resiliency*. Thus *leather*, above all other transmission materials, has the ability to "give" under strain and then "recover". Frequent overloads are handled with minimum slip, without damage to belt, bearings or equipment.



Special "Research" manufacturing processes add a second "plus" to the "plus" you get from any first-quality leather belt — guaranteeing 3% greater production. Exclusive "weight-controlled" curry (shown above) gives maximum pulley grip . . . pre-stretching according to hide characteristics eliminates non-elastic stretch . . . patented "tension-cementing" gives positive ply adhesion strength.

Extra Values from "Research" Belting's

"DOUBLE PLUS"

(all that's *better* in leather, made *best* in "Research")

- **MORE PRODUCTION** with leather belts because of leather's superior traction, which improves with age.
- **MOST PRODUCTION** with "Research" because "Research" processing adds extra pulley grip. 3% more production guaranteed.
- **LESS MAINTENANCE** with leather belts because natural "give-and-take" handles shock loads without undue strain.
- **LEAST MAINTENANCE** with "Research" because pre-stretching removes non-elastic stretch, saving take-ups.
- **LONGER LIFE** with leather belts because leather's tough, interlocking fibres have high resistance to both surface wear and internal friction.
- **LONGEST LIFE** with "Research" because the pre-stretched fibres are properly lubricated by precise, "weight-controlled" currying.

3% MORE PRODUCTION . . . 2 TO 4 TIMES LONGER LIFE . . . FROM "RESEARCH" BELTING'S DOUBLE PLUS

MORE UNIFORM results can be expected from "Research" Belting, manufactured from green hide to finished belt under one roof, under one control, in the world's largest industrial leather plant.

The pivoted-base-flat-leather-belt is the most modern, lowest-cost drive. Write 333 Franklin St., Worcester 4, Mass. for free "Short Center Book".

GRATON AND KNIGHT

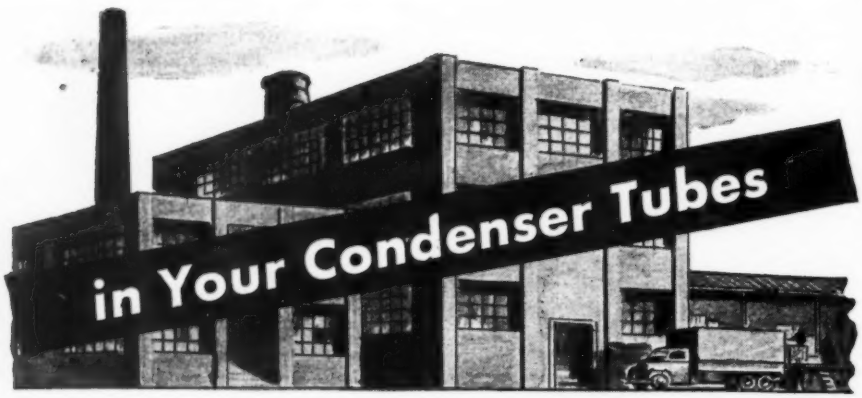
"RESEARCH" BELTING

Graton & Knight Company, Worcester 4, Mass.

Branches and distributors everywhere. Look under "Graton & Knight" in "Belting" section of classified telephone directory or THOMAS' REGISTER.

MICRO SABOTEURS

camouflage as sludge . . .



What look like mere accumulations of mud or sludge in your process water system, may actually be caused by growths of slime, which cause needless power losses.

Not only do the growths attach themselves to the inside of pipelines and condenser tubes and seriously hamper the flow of water and heat transfer, but they entrap particles of dirt and rust to form mud-like masses.

It is not necessary, however, to tolerate such conditions with resultant handicaps in production, nor to waste time in shut-downs for mechanical cleaning jobs.

Wallace & Tiernan Chlorination Methods will thoroughly protect your plant against such microsabotage by destroying slime-forming organisms—clearing out growths already present and preventing their recurrence, without loss of production time.

Let Wallace & Tiernan Engineers suggest the most practical way to solve your particular desliming problem. CD-7

WALLACE & TIERNAN

PRODUCTS · INC.

Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey • Represented in Principal Cities

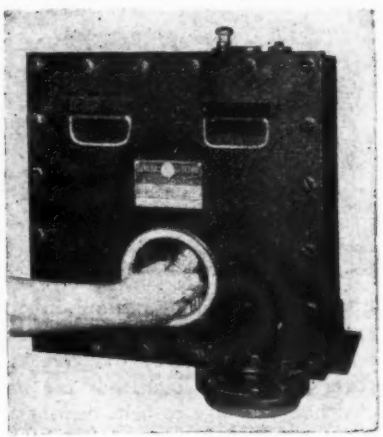
formly excellent results from the standpoint of superior tensile strength and extremely low resistance. *Aircraft-Marine Products, 1523 N 4th St, Harrisburg, Pa.*

Refrigerant Purger

FORCED STEEL PURGER removes air and other non-condensable gases from refrigerating systems. Purger is for high-pressure CO_2, ammonia and freon systems and for service where engineers prefer all-steel construction. Purger is hooked up to both condenser and receiver and is reported to keep system free of non-condensables with no appreciable loss of refrigerant gas. *Armstrong Machine Works, Three Rivers, Mich.*

Composition Floor Runner

WASHABLE DURA-VAL floor runner, in 3x30-ft rolls, is claimed to look, feel and wear like rubber. It has a ribbed, non-skid surface and is waterproof. Runner lies flat and maintains its position under traffic. *So-Lo Works, Inc, Loveland, Ohio.*



Explosion-Proof Starters

AVAILABLE UP TO 50 HP in reversing and up to 100 hp in non-reversing design, ac full-voltage starters are in explosionproof inclosures fabricated of steel plate. Wide flange between cover and body of inclosures is ground to close tolerances to prevent escape of burning gases. Handhole cover facilitates access to line fuses. Heavy-duty switches, contactors and overload relays permit a variety of magnetic interlocked control arrangements. Starters are furnished with simply assembled bell-mouthed packing glands to match cable size. If required, a cable-retaining clamp is also furnished with each starter. *General Electric Co, Schenectady, N. Y.*

Insulation Tester

MODEL C2 MEGOHMER has new spillproof lightweight storage battery as power supply for 500-v dc test potential for insulation resistance measurements. A built-in vibrator transformer circuit steps up low-battery voltage to test potential. Use of wet-cell battery permits recharging and a special built-in charging circuit makes it possible to replenish battery from ac or dc line at any time. The instrument reads

THE WORLD'S

fastest complete

BOILER TUBE SERVICE

● More than 23 years fabricating tubes for all types and sizes of boilers—ample capacity and complete facilities for speed enables us to handle orders in dozen lots or carloads quickly—and to give accuracy and uniformity in each length, in every bend. Write, wire or phone your next order to the "World's Fastest Boiler Tube Service."

BOILER TUBE COMPANY OF AMERICA

3126 PREBLE AVENUE
PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO

FRED S. RENAULD & COMPANY, Los Angeles

Although industrial piping is infinite in its variations, nevertheless, rare indeed is a fabrication such as pictured here: A 60-foot header scheduled for use in a line running 5000 lbs. operating pressure. Strictly a high pressure job requiring extremely well planned welding procedure including the use of pre-heating, stress-relieving equipment.

More and more fabrications of unusual character and requiring exceptional abilities in welding and the use of modern equipment are finding their way into Associated shops. Why is this?

How we handle the first and subsequent jobs you give us will give you the answer.

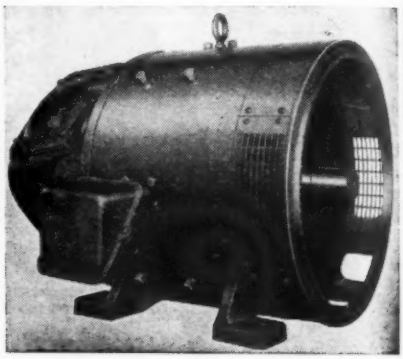
ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

ASSOCIATED *Progressive* **PIPING**

directly in megohms and ohms, has wide coverage and readability, a sensitive meter movement with knife-edged pointer and mirror scale, and a guard circuit to prevent errors through surface leakage. *Herman H Sticht Co, 27 Park Pl, New York, N. Y.*

Plastic Floor Covering

SAF-T-DEK, a heavy non-slip plastic applied to walking areas, holds footing secure and does not wear off easily. Saf-T-Dek is applied with a trowel to a thickness of about $\frac{1}{32}$ in. It is tough and sticks to practically any surface—wood, steel, concrete or glass. On drying, it imparts a skidproof walking or working area. Saf-T-Dek area is also non-slip when wet or covered with oil emulsion. In tile red and concrete gray, Saf-T-Dek may be had in a sparkproof type when non-sparking floors are necessary. *Truscon Laboratories, Inc, Detroit 11, Mich.*



Dc Engine Generator

CENTURY DC ENGINE GENERATORS are available in 1 to 200 kw sizes for direct assembly to engine frame or for belt drive. Generator bolts direct to engine housing and engine shaft. It is equipped with one ball bearing. Engine bearing supports engine end of rotor. Generators are built for voltages ranging 15 to 600 v for a wide variety of applications. *Century Electric Co, St. Louis 3, Mo.*

Power-Driven Brushes

POWER BRUSHING, in six steel-bristled brushing sections, or wheels, spinning as a unit through the boiler tubes, removes carbon and soot quickly. Equipment consists of a power-driven flexible shaft on which are mounted six 3-in. brushing sections, packed with 33-gage crimped wire. Special locking arrangement holds six sections in position on shaft. Removal of carbon and soot is by running shaft, which carries brushing sections, through tubes with the shaft rotating at 1750 revolutions per min. *Osborn Mfg Co, 5401 Hamilton Ave, Cleveland, Ohio.*

Spray Nozzle

FLATJET SPRAY NOZZLE provides a sharp, flat hard-hitting spray. Nozzle is built without cores, vanes or other obstructions, depending solely on design for the desired spray pattern. Standard nozzles are of

FOR GIVING FORCE TO A SLOGAN

From president to porter, everyone at Thermoid knows that continued prestige for Thermoid Products demands more than just a slogan . . . that Thermoid's leadership and growth depend solely upon the quantity and quality of effort contributed by each and every employee.

This concept of service is fostered by special honors awarded regularly for outstanding work. The most coveted of these awards is the "Achievement Medal" pictured here and conferred each year on the three men or women who most nearly reach "approximate human perfection" in performance of their duties.

By emphasizing the fact that an employee's own welfare is linked directly with the common good of company, fellow workers and customers, Thermoid is able to supply products and render services that give force to its slogan: "It's good business to do business with Thermoid".

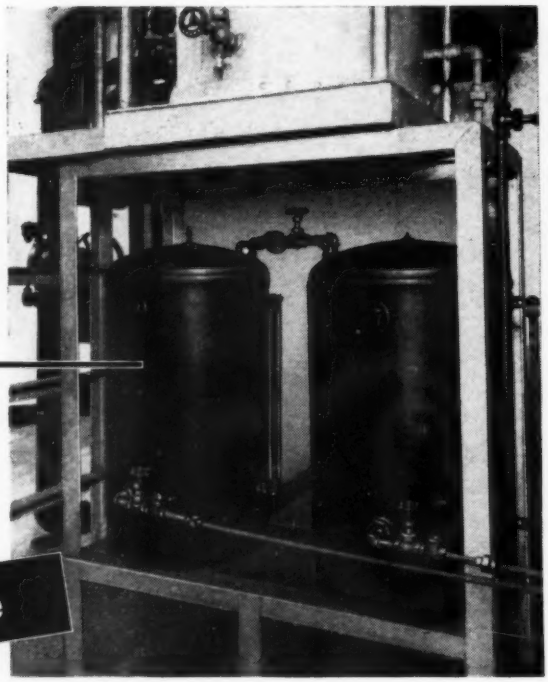
Thermoid
Rubber

DIVISION OF THERMOID COMPANY
TRENTON, NEW JERSEY

THE THERMOID LINE INCLUDES: Transmission Belting • F.H.P. and Multiple V-Belts and Drives • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Sheet Packings • Industrial Brake Linings and Friction Products • Molded Hard Rubber and Plastic Products.

It's Good Business to do Business with Thermoid

Don't put it off 'til tomorrow— BUY MORE WAR BONDS TODAY!



This feeder system applies Santosite efficiently to prevent oxygen corrosion in boilers operated at 675 pounds gauge pressure. Santosite, effective in all types of steam power plants, can be applied by any standard solution feeders.

Santosite

STOPS Oxygen Corrosion

Monsanto Santosite (Sodium Sulphite Anhydrous, Technical) can be applied efficiently and economically to boiler feed water through standard chemical solution feeders. Users' experience shows that 30 parts of Santosite per million parts of water maintained *in the boiler* is *assurance* against oxygen corrosion within the boiler. Such protection means fewer shutdowns and repairs . . . greater economy and efficiency.

If you wish our cooperation in working out the most efficient application of Santosite to your boiler feed water, please get in touch with the nearest Monsanto office or write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.

MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

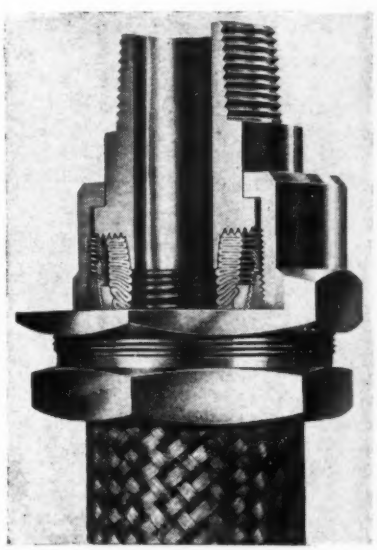
brass, steel or stainless steel one-piece construction. Nozzles may also be made of other materials. Use them with water, brine, oil and liquids of similar viscosities. Size range is wide. *Spraying Systems Co, 4021-S W Lake St, Chicago 24, Ill.*

Infra-Red Lamps

IMPROVED TUNGSTEN FILAMENT of Birdseye LO-Flo infra-red heat lamps is of coil-coil construction. It burns at a lower color temperature, reducing spectral glare to a new low. LO-Glo MM filament increases radiant energy output. MM filament shape eliminates *cold spots* and is said to produce a better focused and more effective pattern of infra-red rays. Life is nearly double that of ordinary drying lamps, according to manufacturer. It has heat-proof Superlok base and ceramic heat reflector disk. *Dept 13, Wabash Appliance Corp, 345 Carroll St, Brooklyn 31, N. Y.*

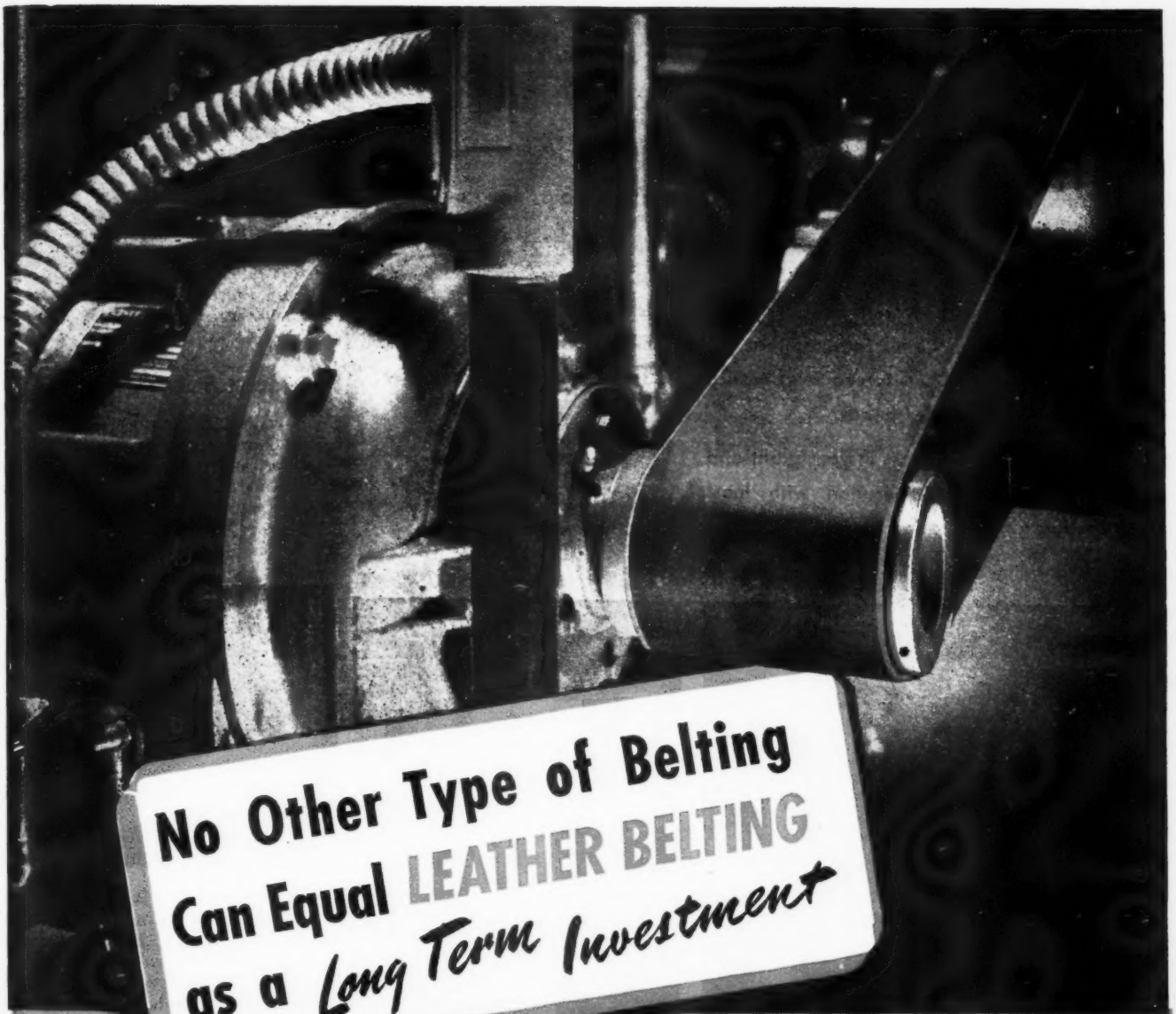
Oil Sludge Pump

NEW 300CPM PUMPING UNIT, powered by a 25-hp. diesel engine, handles oil sludge. Pump has steam-jacketed heads to lower viscosity of pumpage. Engine speed is 1200 rpm, reducing through a double-reduction oil-immersed drive to 300 rpm on pump shaft. Pump discharge pressure is 25 psi. These units are furnished to U. S. Navy. Similar units, powered by diesel, conventional gasoline or steam engines, or electric motor, will be a part of Blackmer postwar line for industrial applications. *Blackmer Pump Co, Grand Rapids 9, Mich.*



Hose Coupling

DETACHABLE BRASS COUPLING for helical flexible metal hose, in sizes from ¾- to 1½-in. ID, is mechanically self-sealing. Unit consists of nut, back, stem and split ring. When assembled, hose convolutions and metal braid are securely held by pressure between members, as shown in photo. Coupling withstands pressure tests up to 800 psi. Self-contained union permits pipe-thread end of coupling to be screwed directly into machine fitting and union tight-



No Other Type of Belting Can Equal LEATHER BELTING as a *Long Term Investment*

Here's Why: It is sound practise, particularly under today's conditions, to purchase *all* operating equipment and supplies with an eye upon the length of service they will provide. While the quality of *most* types of transmission belting has been seriously affected by war-time shortages or restrictions, *it is still possible to obtain FIRST-QUALITY Leather Belting!*

Today's Leather Belting has exactly the same pre-war characteristics that *always* have made it the *best buy . . . long life, exceptional power transmitting qualities, dependability, ease of maintenance, salvage value, adaptability, and high output capacity.*

More and more manufacturers who *think ahead* are installing flat *Leather Belt* Drives . . . because they realize Leather Belting can't be equaled as a *long term investment!*

Here's How to Get the Most From YOUR Leather Belting

That's the title of this very useful book which will help you make *your* Leather Belting give the *longest possible service.* A copy is "yours for the asking" . . . from your Leather Belting supplier or from us.

AMERICAN LEATHER BELTING ASSOCIATION • 53 Park Row, NEW YORK 7, N. Y.

SCHRAMM COMPRESSORS ARE BALANCED

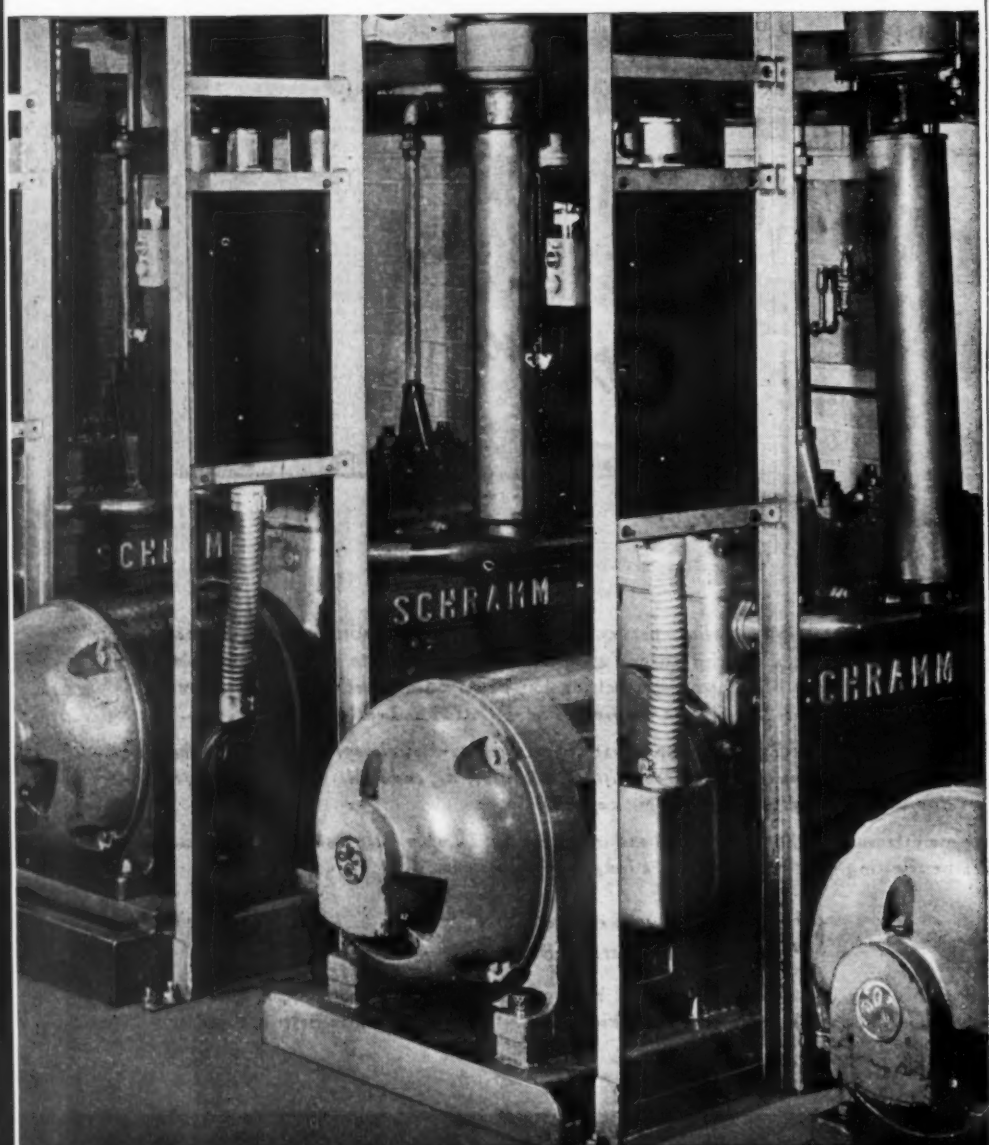
to eliminate vibration

Here's an installation showing just what can be done with an "easy-to-install," compact Schramm air compressor.

The Units represent "Utility" Compressors. Schramm compressors are available with various types belt drives, as well as built-in motor drive and direct connected diesel or gasoline engines. Other features that assure all the air you want include: 1—completely watercooled. 2—forced feed lubrication. 3—mechanical intake valve. 4—sturdy support for cylinder heads.

Specify Schramm Air Compressors in your plant and get heavy-duty continuous operation with least attention, upkeep and operating costs.

Write for full data in Catalog IND-44.



SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

ened without twisting hose. Additional advantages are repeated re-use and easy, assembly with ordinary shop tools. *Packless Metal Products Corp, New Rochelle, N. Y.*

Refrigerating System Purger

MODEL NO. 253 PURGER is for systems with low-suction pressures. The valve, controlled by inverted bucket, discharges liquid refrigerant to liquid supply line instead of direct to refrigerating jacket. Pressure differential across valve is only 1 or 2 psi, which is said to keep wear on valve and seat at a minimum. *Armstrong Machine Works, Three Rivers, Mich.*

Fluorescent Ballast

QUICK-START FLUORESCENT BALLAST with *Instant-Start* fluorescent lamps eliminates need for starters and provides for instantaneous lamp light. There is no time lag between snapping of switch and lighting of lamp. It operates from standard 115/120 primary circuit and boosts the voltage

to approximately 450 v for lamp starting. It is claimed that when used with new *Instant-Start* fluorescent lamps no sacrifice is made in accustomed operating advantages or lamp life. However, for other than *Instant-Start* lamps, lamp life is variably reduced. Ballast is now available in dual 40-watt size for two 40-watt lamps, in either end-lead or bottom-lead designs. *Acme Electric & Mfg Co, Cuba, N. Y.*

Water Arch Furnace

JOHANSON FURNACE makes possible firing of Scotch marine boilers with stokers or other automatic fuel burners at high ratings without smoking. Extension furnace is constructed with 3-in. bent waterwall tubes extending from a lower mud drum running along each side of furnace to a common upper circulating drum at top. Lower mud drums of waterwall are connected to boiler by 4-in. circulating pipes. Upper circulating drum is connected by two 4-in. pipes which enter boiler just below water line. A complete circulating unit of boiler and extension furnace, this design takes water from lowest boiler point.

Attached to a Scotch marine boiler, this furnace is claimed to obtain 200% or more boiler rating with increased efficiency and without smoking. It is also said to lower temperature of gas leaving boiler 20 to 25%, attributed to the fact that furnace has a large cu ft vol so that thorough com-

(*Continued on page* 154)

What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

1. What causes turbine oil deposits or sludge?

Petroleum oils are extremely complex mixtures of hydrocarbons. The basic cause of deposits or sludge in turbine oils is a "thirst" for oxygen on the part of certain of these hydrocarbons. When they oxidize they tend to form asphaltenes or acids or both.

The asphaltene-formers are the quickest to oxidize, with resultant deposit formation. Agitation of the oil under heat in the presence of oxygen and moisture—a natural condition found in turbines—is all that is needed to start trouble.

Oxidation is first indicated in conventional oils by darkening of the oil. Deposits may not become immediately apparent because of their solubility in hot oil. But as their concentration increases, they can no longer be held in solution. Eventually they settle in cooler parts of the turbine, such as oil coolers, and on pump screens, oil lines and filters. Deposits also occur at points of low oil velocity, such as in governors and bearing pedestals, and where centrifugal force operates as in couplings.

The most logical solution would seem to be to remove these asphaltene-formers—it can be done by refining. But it isn't that simple. The asphaltene-formers include natural oxidation inhibitors. Removal of these leaves the oil more susceptible to acidity formation, which causes poor demulsibility and other oil trouble, and may eventually lead to sludge formation.

Because of this, most turbine oils are a compromise. Some of the asphaltene-formers are left in the oil for their inhibiting effects—in spite of the certainty of asphaltene deposits. Acidity formation is slowed down by this, but turbines must be cleaned and the oil sweetened or treated periodically to reduce acidity.

Nonpareil is different. We take out *all* the asphaltene-formers—even though the natural inhibitors go out with them. Then we add an oxidation inhibitor which checks acidity formation even better than the natural ones. Thus, in Nonpareil, deposits from asphaltene-formers are completely eliminated. Causes of acidity and how it is controlled will be discussed in this space next month.

Gasoline Powers the Attack . . .
Don't Waste a Drop!

For all the answers send for this booklet... it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

1 oil does these 3 jobs better than many special oils

THREE most frequent uses of oil in your plant—outside of power generating equipment—are probably in gear cases, air compressors, and hydraulic systems. As widely different as these three jobs may appear to be, one oil—Stanoil—has qualities that fit each use better than many special purpose oils. It offers these advantages:

1. It means one brand of oil to handle and keep in stock in place of three.

2. There is less chance for misapplication of lubricants with fewer oils from which the oiler must choose.

3. It simplifies procedure when oil is reclaimed or re-used for other services.

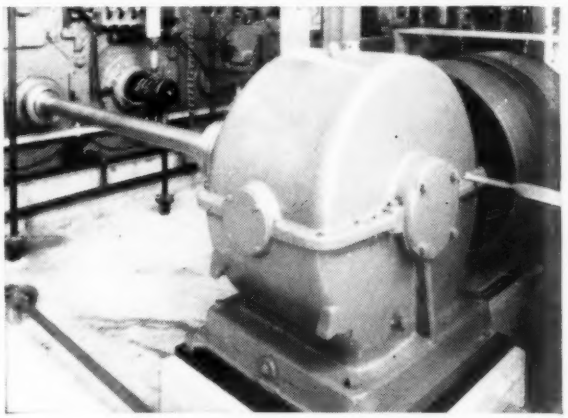
4. There is one convenient source of supply to contact.

These are *plus* advantages. In addition, Stanoil does an outstanding lubricating job wherever it applies. Let a Standard Oil Lubrication Engineer help you standardize your lubrication requirements by applying Stanoil wherever it can be used throughout your plant. Call your local Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

STANOIL

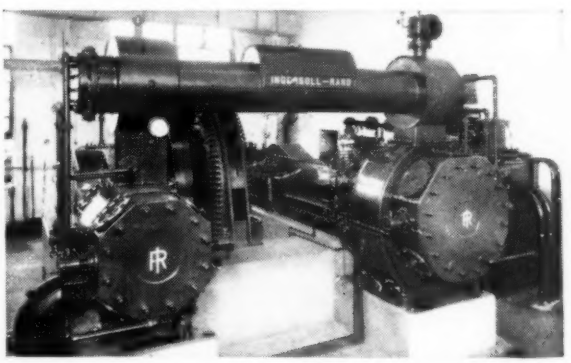
Stanoil as a HYDRAULIC OIL

High viscosity index—an oil's ability to resist changes in viscosity with changes in temperature—is one of the qualities that recommend Stanoil for hydraulic systems. It flows readily at starting temperatures, yet it does not thin out excessively at high operating temperatures, thus providing more uniform operation. High stability against oxidation is another quality of Stanoil that adds to oil life. It prevents the formation of deposits that are so objectionable in hydraulic systems.



Stanoil as a GEAR CASE OIL

High stability of Stanoil is also an advantage in gear cases of speed reducers. Stanoil resists oxidation caused by agitation in the presence of air—a condition natural to speed reducer operation—and prevents the formation of deposits caused by oxidation. Low pour test is a quality of Stanoil which eliminates starting trouble where gear cases are exposed to low temperatures.



Stanoil as a COMPRESSOR OIL

The low carbon-forming tendencies of Stanoil are a great advantage in compressor lubrication. Oxygen in the air and heat generated by compression tend to oxidize oils in compressor service. Again Stanoil's high stability resists oxidation and reduces troublesome valve deposits.

Gasoline Powers the Attack . . . Don't Waste a Drop!

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

HOW *Pan American Airways* PACKS 2,100 HOURS INTO A DAY

THE minute the giant transatlantic Pan American Clippers get back to their base, they get an exhaustive going over.

It's thorough. And it's fast.

A swarm of mechanics, working in eight-hour shifts, get the job done in 60 hours — 2,100 man-hours a day.

What helps this swift turn-around are Elastic Stop Nuts. These nuts have been on every Pan American Clipper since 1928. They are on motors, mounts, wings and countless structural parts.

Particularly timesaving are the Anchor Nuts which permit smooth blind mounting. Hundreds of these fasten the covers for inspection openings. These Anchor Nuts* are an Esna development and are used by millions in all kinds of airplanes.

Elastic Stop Nuts lock tight and fast without any auxiliary devices. There's no time wasted in fussing to get them off and back on again.

They lock because of the elastic collar in the top. This collar squeezes in between the bolt threads. It's compressed tight. The nut can't turn. It can't wiggle. It can't shake loose. And you can take it off and put it on again many times and it still locks.

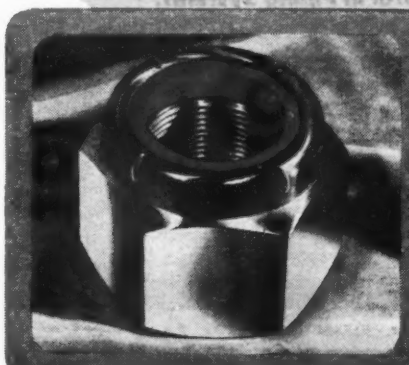
Every fastened product can be better because of these nuts — can be safer, tighter, quieter, and longer lasting.

So if you have a fastening problem now, or see one ahead, let us show you how these red-collared Esna Nuts can help. Our engineers are ready to consult with you and recommend the appropriate nut.

LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING RED COLLAR.
THE COLLAR IS ELASTIC, THE NUT CAN BE USED TIME AND TIME AGAIN.
MADE IN ALL SIZES AND TYPES — WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS.

The Clippers' powerful engines are equipped with Elastic Stop Nuts. Overhauling is simplified by the absence of pins, washers, or other auxiliaries.

*ESNA Anchor Nuts allow ready access to inspection openings, yet refasten tight and strong to carry stressed skin loads.



ESNA

TRADE MARK OF
ELASTIC STOP NUT CORPORATION
OF AMERICA

ELASTIC STOP NUTS

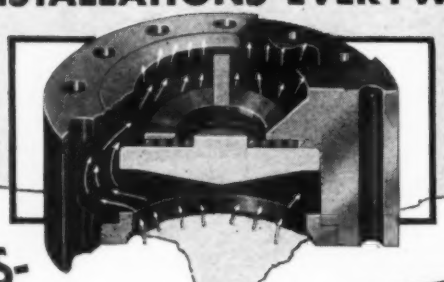
Lock fast to make things last

UNION, NEW JERSEY AND
LINCOLN, NEBRASKA

Preventing . . .

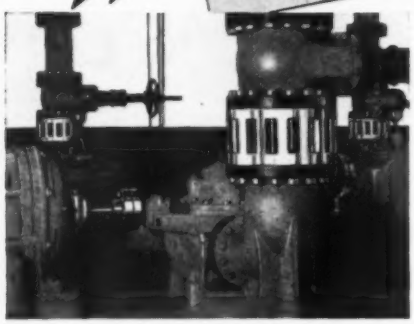
COSTLY, DESTRUCTIVE "WATER HAMMER"

WITH INSTALLATIONS EVERYWHERE!



WILLIAMS-HAGER

FLANGED Silent CHECK VALVES



Three 10"-300 lb. Williams-Hager Flanged Silent Check Valves in Radio City, N. Y.

Eliminates

Costly Breakdowns in Pumps and Piping Systems with Operating Pressures up to 6000 lbs!

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provides uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, salt water, brine, etc., etc., regardless of temperature.

Write today for interesting folder on "Water Hammer—Cause, Effect and Control in Piping Systems."

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

2055 PENNSYLVANIA AVENUE • PITTSBURGH (12), PA.

bustion occurs in furnace before entering cooling surfaces. Directly exposed to radiant heat of the fire, the tubes add heating surface to boiler. Waterwalls allow operation at high ratings without excessive refractory maintenance and serve to support the arch, eliminating need for suspended arch construction. *Page Boiler Co, 815 W Webster Ave, Chicago 14, Ill.*

Sediment Strainer

ADSCO Y SEDIMENT STRAINER has a working pressure of 125 psi. Strainer has a semi-steel body and removable, perforated, non-corrosive metal screen. Y strainer is available from ½- to 2-in. pipe sizes with screwed ends. It is recommended for installation ahead of regulating and control valves, traps and other apparatus, which may be harmed by a carryover of sediment in steam, condensate or liquids. *American District Steam Co, N Tonawanda, N. Y.*

Hole Cutters

ADJUSTABLE HOLE CUTTER SET covers all diameters from ⅝ to 3½ in. Set cuts holes in stainless steel, cast iron, brass, fiberboard, plastics, etc. It is claimed that balance provided by special 3-blade design makes it possible to cut holes in curved or irregular surfaces, such as piping or tubing. *Robert H Clark Co, 9330 Santa Monica Blvd, Beverly Hills, Calif.*

Motor Starters

ZHS STARTERS, for full-voltage starting of 2300- 4150- and 4600-v motors, are available in the following ratings: (1) moderate interrupting capacity—ten times full-load motor current (2) 25,000 kva interrupting capacity (3) 50,000 kva interrupting capacity. Starters are also in standard form, in combination form with self-contained disconnect switches and in Type VIII inclosure for Class I, Group D hazardous locations. *Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, Ohio.*

Welding Electrodes

GRADE P-61 is a shielded-arc general-purpose straight-polarity dc electrode for welding mild steel in all positions. It is designed especially for fast production where high currents are used and arc action is strong. P-103 is a shielded arc ac electrode for all-position welding. This

DUCK AND RUBBER PACKINGS

... for use on Pistons and Outside Packed Plungers

Here is a packing especially designed for use on pistons and outside packed plungers, operating on hot or cold liquids. Made in two cures—regular and semi-hard—the regular cure is for water services ranging from cold to 125° F. ... the semi-hard for hot water. Sizes from ¼" to 1¼". Construction has proved superior to the old style fine hydraulic types and the soft coarse tucks packing.

Ring form may be ordered as follows: 1. Endless, cut from slab. 2. Beveled joint. 3. Butt joint. 4. Step joint.

It will pay you to use this packing. Write for details.

THE ANCHOR PACKING CO. TRADE A MARK

THE ANCHOR PACKING COMPANY

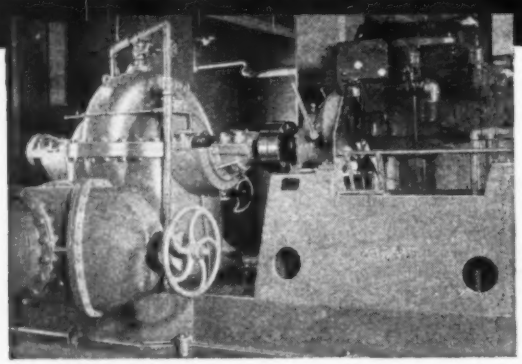
GENERAL OFFICES: PHILADELPHIA 8, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

Baltimore 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets
Boston 14, Massachusetts	303-04 North Station Building, 150 Causeway Street
Buffalo 2, New York	Andrews Building
Cleveland 13, Ohio	523-25-27 Rockefeller Building
Columbus 9, Ohio	172 North Cassingham Road
Chicago 11, Illinois	200 East Illinois Street
Cincinnati 2, Ohio	4 West 7th Street
Detroit 26, Michigan	169 West Jefferson Avenue
Houston 2, Texas	509 Washington Avenue
Kansas City 6, Missouri	1332 Oak Street
Los Angeles 21, California	720 Mateo Street
Montreal, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	4417 West North Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania	401 North Broad Street
Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 5, Oregon	Terminal Sales Building
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	207 Avalon Boulevard

PERFORMANCE . . .



The final test of PACKING value

Materials . . . construction . . . manufacturing skill and care . . . experience . . . these are all important standards by which to judge a packing; but in the last analysis, actual service records are the final test.

Here are some records of G-T Packing service, taken at random from our files. Space does not permit more than a few, but we shall be glad to give additional details on services similar to your particular conditions:

"We find that PALMETTO (for steam, hot water, gases) is lasting longer and holding tighter with less friction than any of the numerous packings we have ever tried."

●

"With packings previously used, pump shaft sleeves had to be replaced every three months. Do not notice any wear since changing to PALCO (for cold water) four years ago."

●

"PELRO (for solvents, oils) has exceeded our wildest hopes in preventing leakage without increasing shaft temperature, and shows the greatest dependability we have ever found in any packing."

●

"SUPER-CUTNO (for acids) is giving us double the service of other packings formerly used."

Performance records like these PROVE that you, like thousands of other Engineers all over the world, will find that G-T Packings can materially reduce your operating costs.

THIS IS THE **8th** of a series explaining why G-T PACKINGS give better service.

8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service.
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience
8. PERFORMANCE . . . proven in thousands of plants of every type

GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York 66, N.Y.
PLANTS: New York, N. Y. and North Wales, Pa.

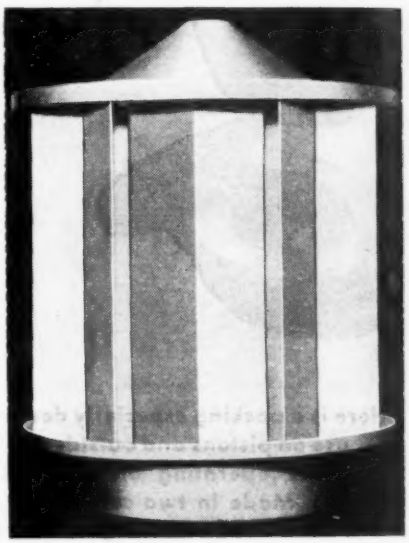
PALMETTO *for steam, hot water, air.* PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT **PACKINGS**

G-T *self-lubricating* **PACKINGS**

electrode is also for welding low-alloy high-strength steels when these steels are used primarily for their high-strength properties. P-170 and P-180 are bare and wash-coated electrodes. These are straight polarity dc electrodes which have a broad application where physical properties indicated in specifications are acceptable. *Anthony Carlin Co, 2717 E 75th St, Cleveland, Ohio.*

Thermoplastic

CEREX IS A THERMOPLASTIC, readily moldable in standard molding machines, which is said to combine high resistance to heat with resistance to strong, corrosive chemicals, excellent electrical insulating properties and high rigidity and strength. Boiled or sterilized plastic retains strength and shape. Applications for Monsanto Cerex include switches, panel boards, rectifiers, transformers, rheostats, voltage regulators, etc. *Monsanto Chemical Co, St. Louis 4, Mo.*



Wind-Actuated Exhauster

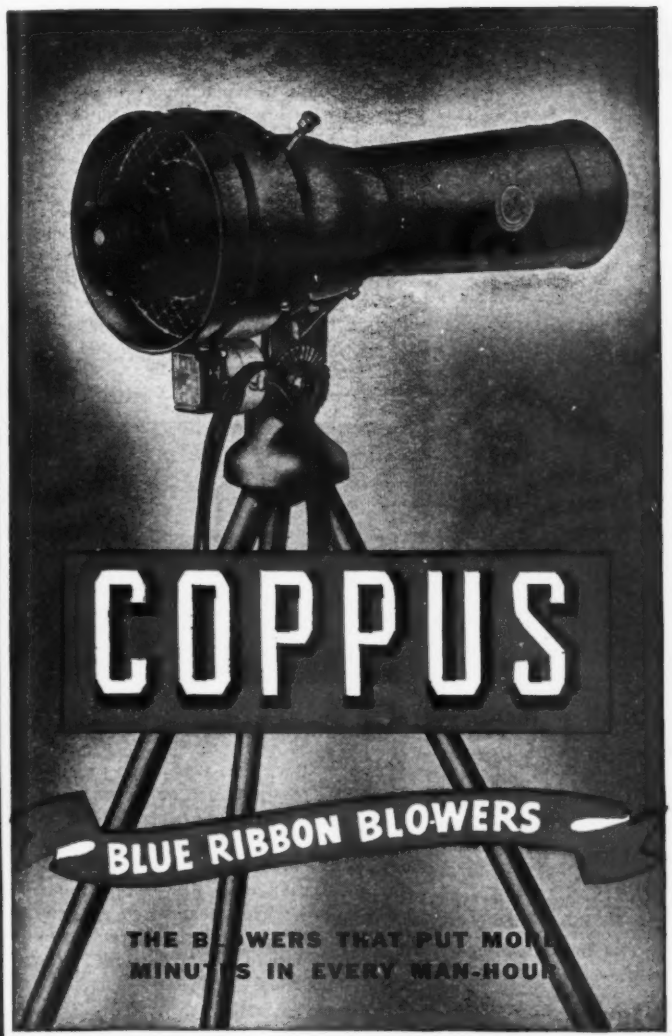
FOR GRAVITY AND MECHANICAL EXHAUST systems, wind-actuated exhauster gives positive ventilation regardless of wind direction or velocity. Having no moving parts, unit provides positive elimination of down draft. Exhauster is weatherproof and lightproof. Many standard sizes have special arrangements when required by application. Agitair exhausters may also be installed as porthole ventilators. *Air Devices, Inc, 17 E 42nd St, New York, N. Y.*

Magnet Wire

FORMEX RIBBON-RECTANGULAR magnet wire, for the war program, comes in shapes as thin as 0.004 in. Smooth, strong, flexible and able to withstand high-speed winding without insulation damage, wire offers many application possibilities to producers of electronic devices and other electric components. In coil winding, varnish treatment, assembly and actual operation, this wire is said to present many advantages. Its final dielectric strength, judged by its reaction to abrasion and winding, and resistance to abrasion, heat shock and sol-

New Strength through Air

WORKERS HAVE MORE WAR PRODUCTION "DRIVE" WITH A COPPUS BLOWER OR HEAT KILLER NEARBY



Thousands of cases prove that a man can do more work where it's cool and comfortable than where heat and bad air are continually sapping his energy.

In these cases, Coppus "Blue Ribbon" Blowers and Exhausters have earned their salt, bringing renewed energy, skill and morale to men working near furnaces . . . in tanks . . . in underground cable manholes . . . around hot processes.

Portable, adaptable for special purposes, each one built with Coppus "Blue Ribbon" precision and strength, they are putting more working minutes into every war-essential man-hour—more and better production every day!

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 518 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have.)

"I gotta date with 1000 Jeeps! Call AIR Express — NOW!

IF AIR EXPRESS shipments could talk—and knew where they were going and why—we wouldn't have to urge you to *ship when ready*, especially if you are a manufacturer of war materials. For early shipment is the way to be certain of *earliest possible delivery*. Don't let shipments lie around for routine end-of-day pick up. Call AIR EXPRESS the instant the label is on. No matter what the label says, it isn't AIR EXPRESS until it's *on a plane!*

A Money-Saving, High-Speed Wartime Tool For Every Business

As a result of increased efficiency developed to meet wartime demands, rates have been reduced. Shippers nationwide are now saving an average of more than 10% on Air Express charges. And Air Express schedules are based on "hours", not days and weeks—with 3-mile-a-minute service direct to hundreds of U. S. cities and scores of foreign countries.

WRITE TODAY for "Vision Unlimited"—an informative booklet that will stimulate the thinking of every executive. Dept. PR-8, Railway Express Agency, 230 Park Avenue, New York 17, N. Y., or ask for it at any local office.

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vents, is claimed to be greater than that of other enameled wire. Because of its thinness, ribbon-rectangular instead of round wire can be applied. New magnet wire increases winding space and, in place of larger-size, rectangular magnet wire, increases magnetic effect or reduces coil size. *General Electric Co, Schenectady, N. Y.*

Machine Gas-Cutting Guide

POCKET-SIZED SLIDE GUIDE shows proper tip sizes, gas pressures and other data for gas-cutting steel of various thicknesses, with Airco 45 and 124 machine-feed gas-cutting tips. By setting slide to one known factor, such as steel thickness, operator may immediately determine correct tip size, oxygen and acetylene pressures, estimated gas consumption, width of kerf and average cutting speed to expect. Guide lists helpful hints for machine gas-cutting operators, including pointers on setting up, piercing starting holes, making heavy cuts, etc. Obtain free copy by writing direct to company. *Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.*

Streamlined Ballasts

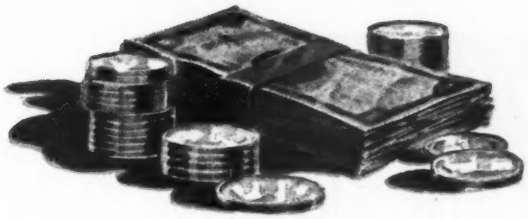
TULAMP 40-W BALLASTS, in streamlined drawn-steel cases, fit contours of lightweight fluorescent fixtures. Ballasts are for external mounting on fixtures, with leads out the bottom of ballast case. This makes possible the installation of ballasts atop a narrow and shallow wiring channel in an exposed position. Tulamp ballasts operate in lower ambient temperatures. *General Electric Co, Schenectady, N. Y.*

Power Supply Units

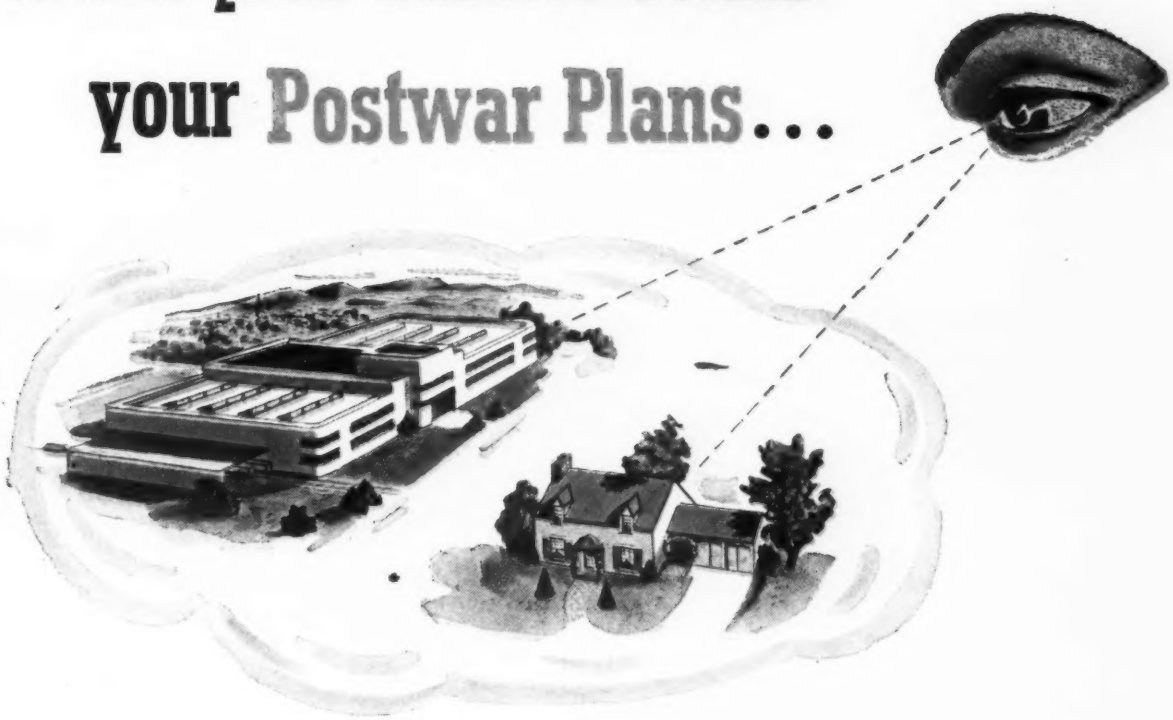
SELENIUM RECTIFIER power supply units of 1, 5 and 10 amp at 115 v dc are for operation of magnetic equipment, dc motors, relays, circuit breakers, carbon arc lamps, battery chargers, etc. In addition to these sizes, Federal offers individualized design and manufacture where equipment for other capacities is required. Units are for wall or bench mounting and need no special connections. *Federal Telephone & Radio Corp, 23 Halsey St, Newark, N. J.*

Weld Testing Machine

PORTABLE MACHINE performs reduced section transverse tension test, guided bend test (a complete 180 deg face or root bend), and longitudinal all-weld metal tension test (0.505 in.). Manufacturer stresses two advantages: (1) ability to provide accurate data on tensile strength



When your banker scans your Postwar Plans...



Will inadequate wiring suggest early obsolescence?

● Poor roofing and plumbing are obvious features that label a property a "bad risk" for financing. Inadequate wiring, although not always so obvious, counts for even more.

Naturally you want to guard against early obsolescence—whether it's a home or a factory. And of course you want to be able to take full advantage of all the electrical possibilities ahead... from finger-tip home conveniences to latest power devices for efficient manufacturing. For either or both – adequate electrical wiring must come first.

Make *sure* of expansion capacity—peak efficiency from electrical circuits, service equipment. Now is the time to bring these important factors into the planning stage: your consulting engineer, electrical contractor, utility power engineer.

Unwired planning will cost you a lot more than planned wiring. 44242

ANACONDA

HELP BRING VICTORY SOONER • BUY MORE WAR BONDS

ADEQUATE WIRING SERVES AND SAVES — KEY TO POSTWAR PROGRESS

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4... Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .

We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

STACKS
•
BREECHINGS
•
UPTAKES
•
HOPPERS
•
AIR DUCTS

RECENT INSTALLATIONS

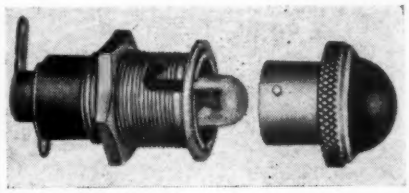
NEW HAMPSHIRE GAS & ELECTRIC CO.	PORTSMOUTH, N. H.
UNITED ILLUMINATING CO.	BRIDGEPORT, CONN.
ROCHESTER GAS AND ELECTRIC CO	ROCHESTER, N. Y.
INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. & LIGHT PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
U. S. NAVAL TRAINING STATION	GREAT LAKES, ILL.
HENRY DISSTON SONS	PHILADELPHIA, PA.
QUARTERMASTERS DEPOT	PHILADELPHIA, PA.

CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

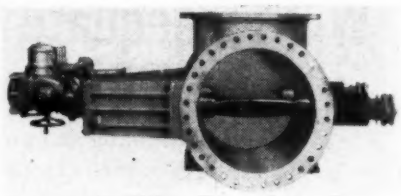
and ductility of weld specimens, as determined by the three tests; (2) relatively lightweight to perform weld tests right on the job.

Machine operates on principle of hydraulic jack. Hand-operated pump transmits pressure through a hose to plunger. While maximum direct load is 40,000 lb, reduced section specimens permit metal tests of 150,000 psi or higher tensile strength. Jaws for transverse tension test, and plunger and die for guided bend test, are supplied with the machine. Jaws for longitudinal all-weld-metal tension test are furnished on special order. All standard equipment has an oak cabinet. *Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.*



Indicating Light

KIRKLAND T3-BLC INDICATING LIGHT unit, with a bayonet-locked lens cap, is for single-hole mounting on a panel. T3-BLC unit embodies a new design of lamp socket and provides a direct electrical connection from shell and center contact pin to terminal spades. Unit is for use with a T3¼ single-contact bayonet lamp bulb. Lens cap is inserted and held in place exactly as a bayonet lamp bulb. It is for applications where shock and vibration are excessive. *H R Kirkland Co, Morristown, N. J.*



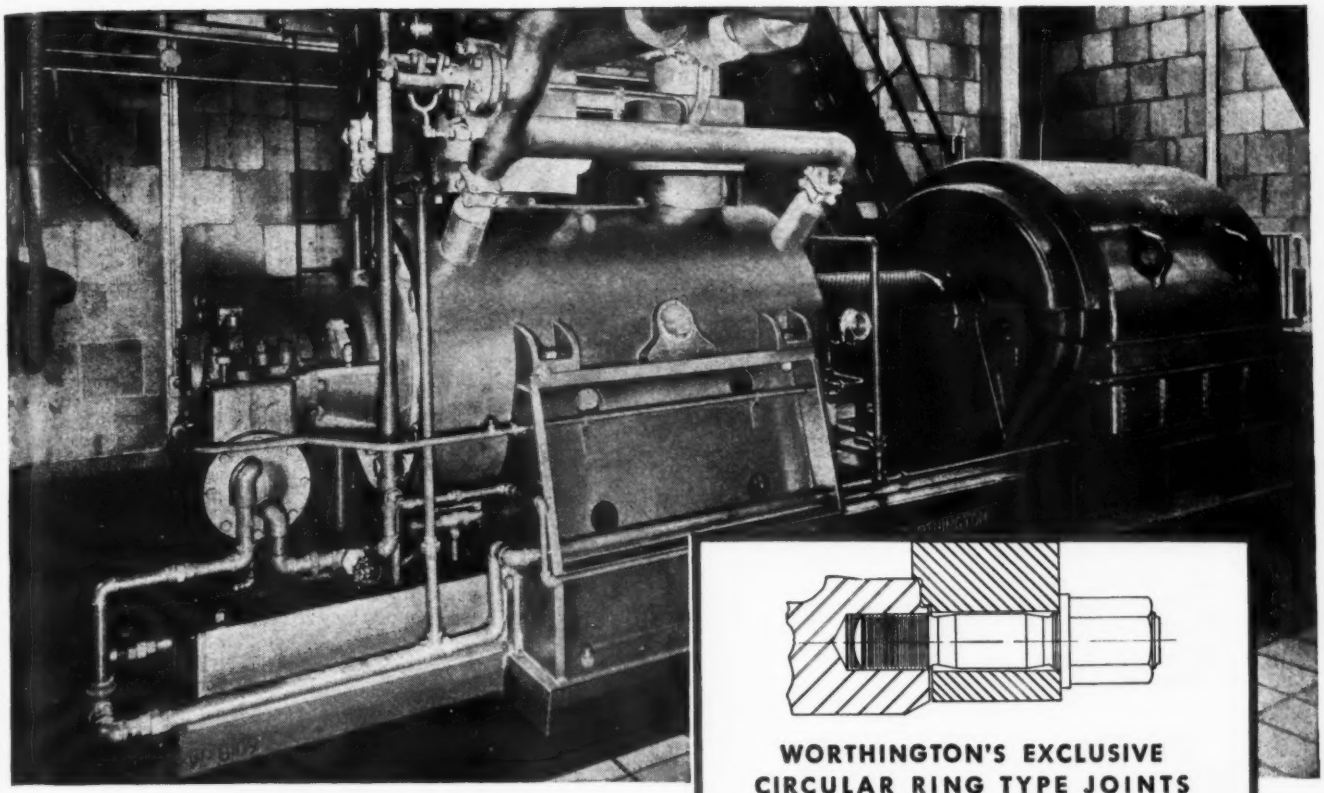
Three-Way Valve

SIMPLIFIED DESIGN and quick action of modern butterfly valve has been applied to No. 604 3-way valve, for quick interchange and mixing service and for all pressures from 15 to 900 psi. It is adapted to manual control as well as power operation and elevated temperatures. Weight of electric motor-operated unit is 8500 lbs. Dual-finned lubricated stuffing boxes are provided for elevated temperature and high working pressure. *R-S Products Corp, Wayne Junction Philadelphia 44, Pa.*

Moistureproof Plastic

A TOUGH MOISTUREPROOF PLASTIC, *Fosterite*, greatly lengthens electrical equipment life in hot humid atmospheres. As an insulating impregnant for electrical coils, it is almost as fluid as water and completely fills every interstice in windings. A special coating form can be applied to apparatus,

30,000 HOURS . . . AND MORE!



WORTHINGTON'S EXCLUSIVE CIRCULAR RING TYPE JOINTS

Only Worthington's WC solid case boiler feed pump uses circular ring-type joints throughout, universally accepted as best construction for high pressure equipment. No gaskets needed.

Worthington High Pressure Boiler Feed Pumps make records for continuous operation in many plants

A typical station reports "32,627 continuous hours without major or minor overhaul"—an outstanding record, but not exceptional when you install a Worthington.

In 1923, Worthington supplied the first high pressure (above 1200 p.s.i.) boiler feed pump ever installed in the U. S. Since then, Worthington has consistently led the field in the number of installations in plants using steam at 1200 p.s.i. pressure or above.

Get the Right Pump for the Job

Worthington's WC high pressure boiler feed pump, shown here as installed in a leading power plant, is only one example of the application experience that will help you solve your specific boiler feeding problem.

"Know-How" from Unit Responsibility

It is natural that Worthington, with years of experience in engineering power plant equipment—from prime movers to valves and V-belts – should be able to place *more* "know-how" at your service. Write us. The Worthington Pump and Machinery Corp., Harrison, N. J.

BEHIND THE NAME
WORTHINGTON

CP4-13

WORLD'S LARGEST MANUFACTURER OF PUMPS

STEAM POWER ROTARY TURBINE WELL CENTRIFUGAL

THIS BEARING BRONZE has real advantages . . .

1 CRYSTAL CONTROL — *Magnolia Isotropic Bronze* is cast by an exclusive method which controls the growth of the crystals. The result is a bearing stock that will stand much greater strain than a bronze whose crystal growth is haphazard and undirected.

2 DIE CASTING — When bearing stock is die cast there is no danger of bars being shot full of tiny diamond-hard points of sand that ruin valuable cutting tools and wear shafts like sandpaper.

3 FULLY MACHINED — Bars that are fully machined save from 25% to 50% of the weight usually purchased in rough-cast-foundry-bars, and an equal percentage of machining time. Finished inside, outside, and on the ends, Magnolia Isotropic Bronze requires only a finish cut to bring to size.

Write for folder which explains these advantages in detail.

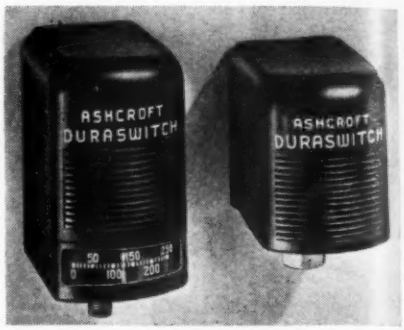
MAGNOLIA METAL CO.
18 West Jersey Street
Elizabeth 4, New Jersey

MAGNOLIA ISOTROPIC DIE-CAST BRONZE
by the makers of MAGNOLIA ANTI-FRICTION METAL

MAGNOLIA METAL CO. OF CANADA, Ltd.
2028 Manufacturers Street
Point Ste. Charles, Montreal

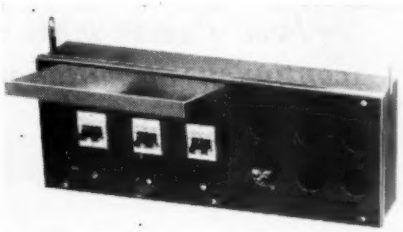
MAGNOLIA BEARING METALS

leaving no air gap through which moisture might enter. Unlike other varnishes, *Fosterite* requires no liquid solvents that evaporate during heating and leave tiny cracks, but fuses into an impenetrable solid when heated. Transformer windings coated with this material give satisfactory performance under water for months. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*



Switch Combination

DURASWITCH IS A SWITCH in combination with Ashcroft gage. Gage has slide-rule dial, easily readable for accurate adjusting of switch to control point. Series E-100, shown in photo, are for pressure only; series E-200 are for pressure and temperature applications, as a pressure-control and pressure-gage combination, or temperature-control and thermometer combination, in single or duplex designs. *Electro mechanical div, Manning, Maxwell & Moore, Bridgeport, Conn.*

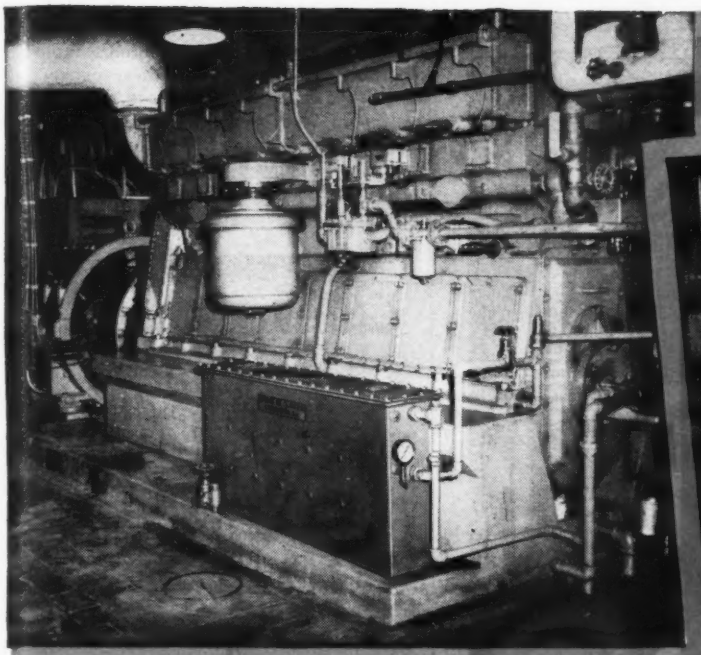


Scatter Box

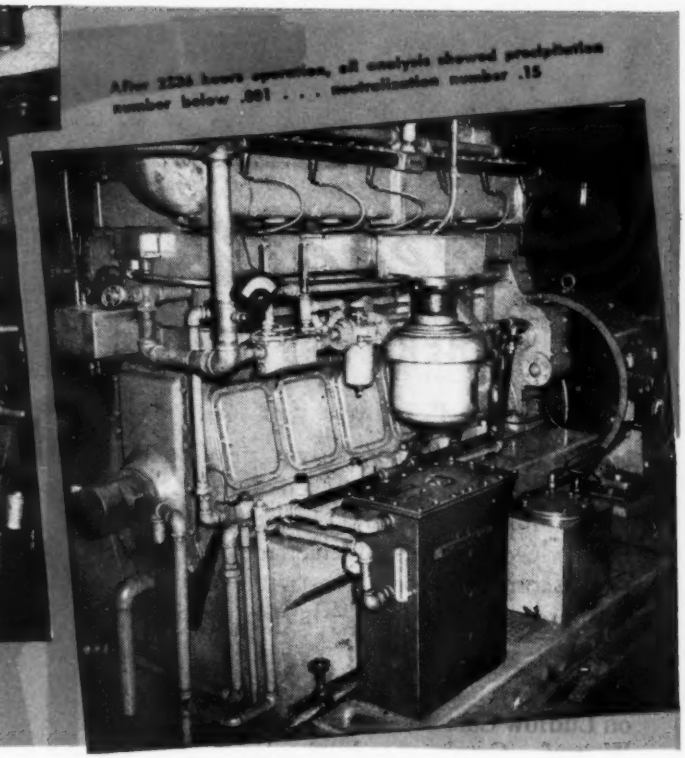
DEVICE PERMITS CONTROL of temporary power and light circuit through a central unit protected by circuit breakers. Scatter box is built for four to eight circuits, with or without neutral. Circuits are protected by 15-amp 115-v single-pole MO multi-breakers, although 20- or 25-amp breakers may be substituted. Hinged cover of scatter box can be padlocked and openings for plug receptacles are provided. One 1-in. knockout in each end is included and box has a pair of ears for hanging. Receptacles or internal wiring are not provided. *Square D Co, 6060 Rivard St, Detroit 11, Mich.*

Rotary Pumps

SPECIAL VANE ROTARY PUMPS have capacities ranging from $\frac{3}{4}$ to 10 gpm. Pumps are lightweight and operate quietly. Built-in relief valve is optional. Pumps are furnished with base and flexible coupling for direct connection to prime mover, for V- or flat-belt drive and with special design brackets to meet mounting specifica-



After 1492 hours operation, oil analysis showed precipitation number below .001 . . . neutralization number .25



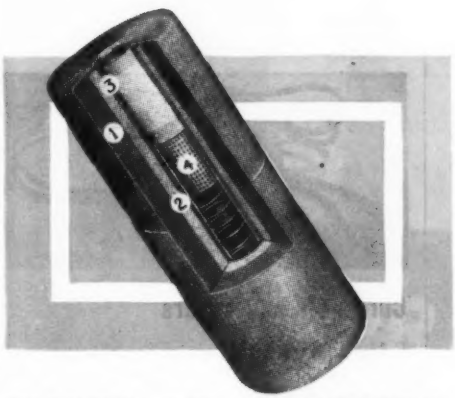
After 2226 hours operation, oil analysis showed precipitation number below .001 . . . neutralization number .15

Evidence THAT BRIGGS OIL CLARIFIERS CONSERVE OIL BY KEEPING IT *"Refinery Pure"*

And that isn't the complete story! These two Cooper-Bessemer Diesels that carry the night lighting and elevator load at the plant of Wm. R. Warner Chemical Company, manufacturers of Richard Hudnut Perfumes, have required no major repairs since the Briggs Clarifiers were installed. Average refill life on the main engine is approximately 1800 hours . . . on the auxiliary engine 3,385 hours. Operating figures show that the savings in oil consumption alone have paid for the Briggs Clarifiers three times over.

Briggs Oil Clarifiers can give you savings and added performance on your internal combustion engines . . . no matter what their type or size—because there is a Briggs Oil Clarifier designed to meet every oil filtration problem on lube oil or fuel oil.

Get the facts! See the Briggs representative nearest you.



BRIGGS OIL CLARIFIERS CLEAN OIL 3 TIMES..3 WAYS

PHYSICALLY CLEAN
Dust, grit, metal chips are removed by ABsorption through cellulose (1).

CHEMICALLY PURE
Acids, gums and resins that cause corrosive sludge are removed by ADsorption through Briggs Patented Molded Fullers Earth Block. (2)

VISIBLY CLEAN
Particles as small as 7 microns (.0003") are removed by ABsorption through second layer of cellulose. (3)

★

There is a specially-processed, long-fibered, all-cellulose Briggs Refill which can be used when your oil supplier does not approve Fullers Earth Filtration.

Briggs

PIONEERS IN MODERN OIL FILTRATION

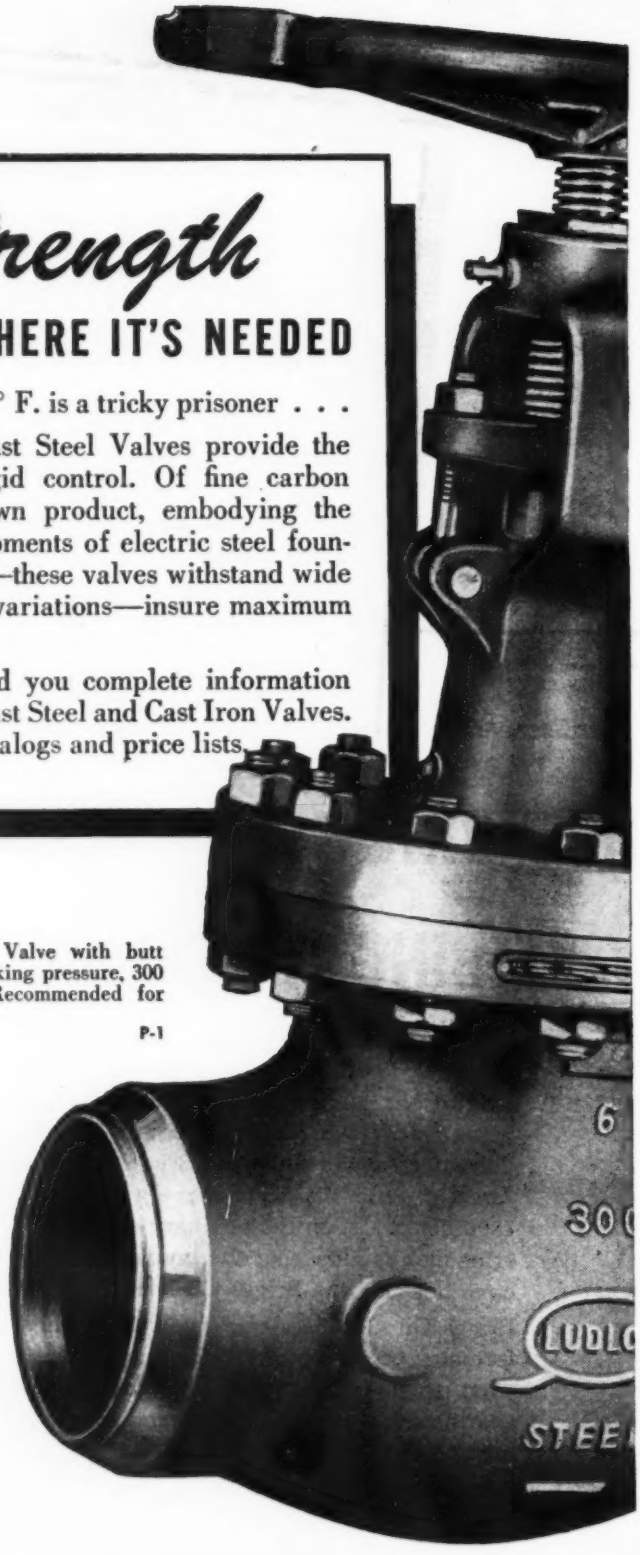
BRIGGS CLARIFIER COMPANY
1339 WISCONSIN AVE., N. W., WASHINGTON 7, D. C.
REPRESENTATIVES IN PRINCIPAL CITIES

Strength
WHERE IT'S NEEDED

Vapor at 850° F. is a tricky prisoner . . .

Ludlow Cast Steel Valves provide the necessary rigid control. Of fine carbon steel—our own product, embodying the latest developments of electric steel foundry practice—these valves withstand wide temperature variations—insure maximum flow.

Let us send you complete information on Ludlow Cast Steel and Cast Iron Valves. Write for Catalogs and price lists.



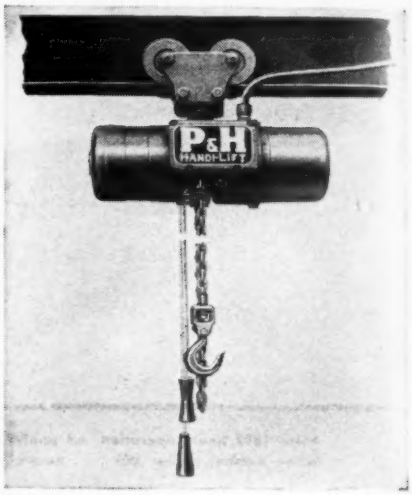
Ludlow Fig. 3004.
Cast Steel Globe Valve with butt welding ends. Working pressure, 300 lbs. at 850° F. Recommended for steam, oil or gas.

P-1

The LUDLOW VALVE MFG·CO·INC· TROY·N·Y·

SINCE 1866

tions. Pumps are all iron, bronze fitted or bronze construction. Because of special bucket design, they are said to be self-adjusting for wear, maintaining normal capacity throughout life of buckets, which are easily replaced when worn out. *Blackmer Pump Co. Grand Rapids 9, Mich.*

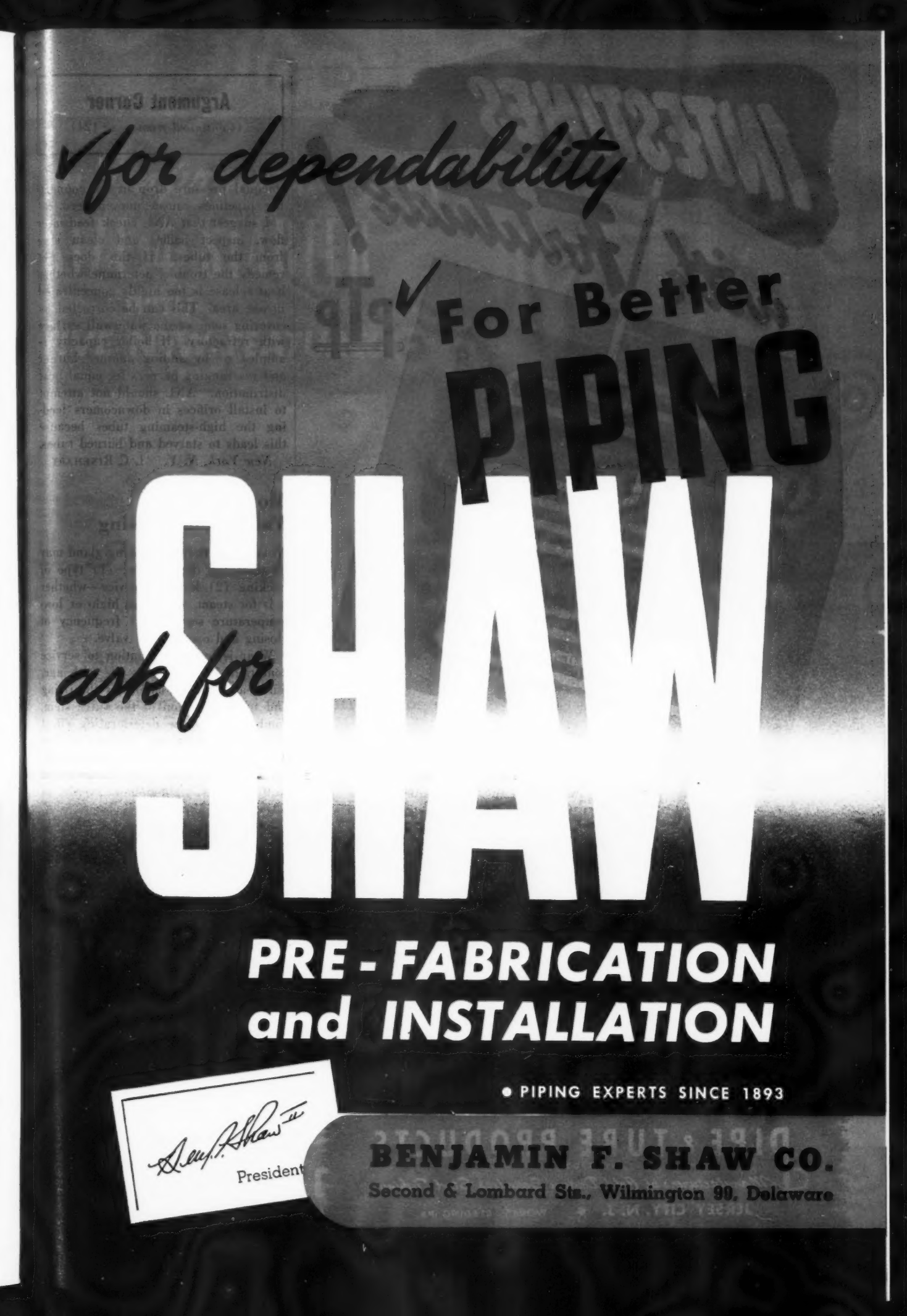


Electric Chain Hoist

INCREASED UTILITY is claimed for the *Handi-Lift*, a 500-lb electric chain hoist, by quick interchangeability to bolt, hook or trolley mounting, with changeover requiring the loosening of one bolt only. Also, in trolley service, it can be suspended either parallel or crosswise to beam for greater flexibility. Operation is by pull cord actuating a simple lever toggle arrangement, which leaves one hand free to guide load. *Handi-Lift* motor is of high-starting torque, reversible type with bearings sealed in grease for lifetime. Unit operates on 3 phase 60 cycle, 220 or 440 v. Chain is proof-tested for 1800 lb. *Hoist div, Harnischfeger Corp, Milwaukee* 14, *Wis.*

Current Transformers

E-M DoNUT CURRENT TRANSFORMERS are of inserted-primary design for any indicating ac ammeter. DoNUT is slipped over bus or conductor to be measured, taped or lashed in place for permanent installation, and leads are connected to ammeter. DoNUT transformers are built standard in 200/5, 300/5, 400/5 and 500/5 ampere ratios; special ratios can be furnished. Ratio accuracy is 1% for ranges above 300 amperes and 2% for ranges 300 amperes and below on frequencies of 25 to 133 cycles, and from 15% to 150% load. Rated burden is 2 va. Lower ratios than those listed above may be obtained by passing primary conductor through transformer two or more times. *Electric Machinery Mfg Co, Minneapolis* 13, *Minn.*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✓For Better
PIPING
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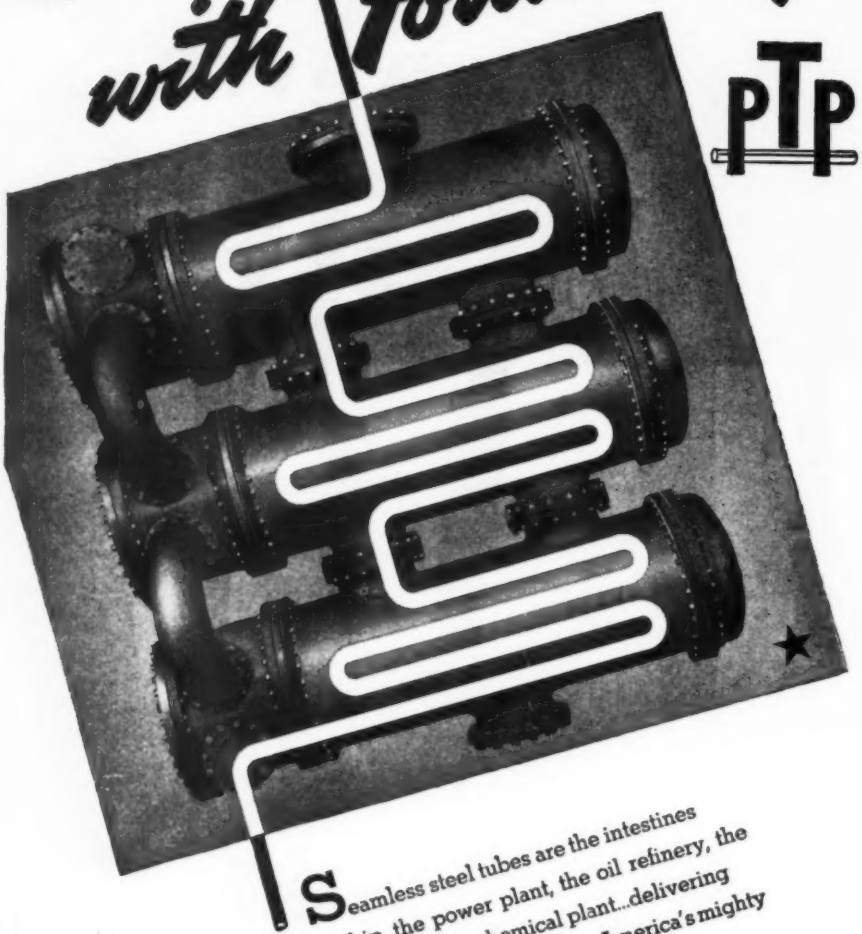
SHAW
PRE-FABRICATION
and INSTALLATION
• PIPING EXPERTS SINCE 1893
President
BENJAMIN F. SHAW CO.
Second & Lombard Sts., Wilmington 99, Delaware

INTESTINES with Fortitude!

PTP



Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

★ Heat Exchangers. Photograph courtesy of the Whitlock Manufacturing Company, manufacturers of heat transfer equipment.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

Argument Corner

(*Continued from page* 124)

unequal pressure drop in the connecting pipelines causes uneven feed.

I suggest that ANL check feedwater flow, inspect baffles and clean slag from the tubes. If this does not remedy the trouble, determine whether heat release is too highly concentrated in one area. This can be corrected by covering some of the waterwall surface with refractory (if boiler capacity is ample) or by adding another burner and rearranging burners for equal heat distribution. ANL should not attempt to install orifices in downcomers feeding the high-steaming tubes because this leads to starved and burned tubes.

New York, N. Y. L C RINEHART

More About Valve-Stem Packing

NUMBER OF TIMES a packing gland may be tightened depends on: (1) type of packing (2) kind of service—whether it is for steam, water, oil, high- or low-temperature service (3) frequency of closing and opening the valve.

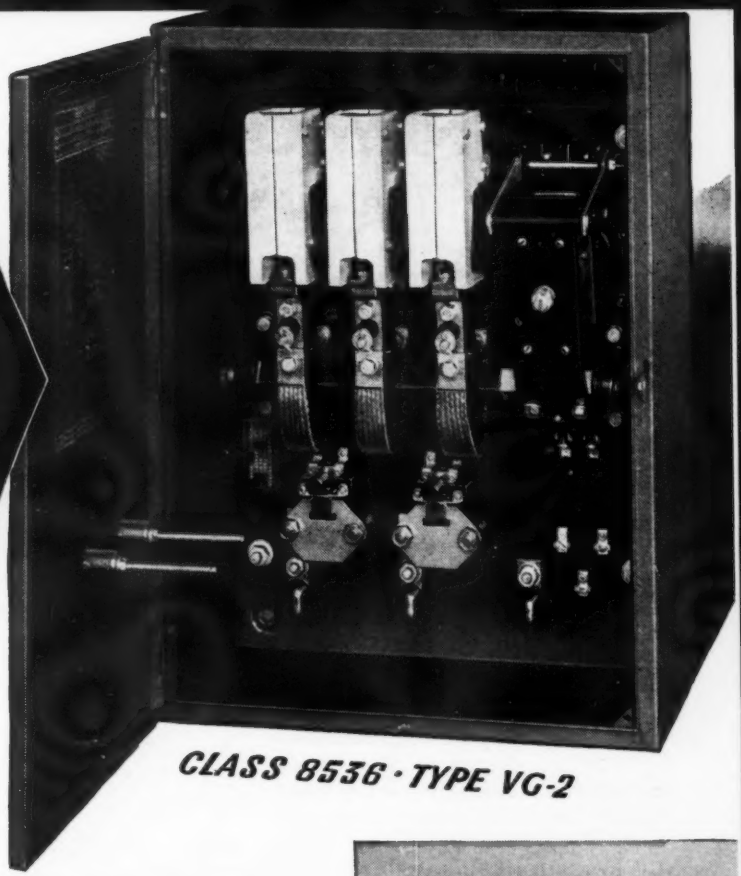
Wear is in direct relation to service condition. Packing loses life with age, but wear is caused chiefly by the rising and turning motion of the valve stem, combined with the deteriorating effect of service conditions. Placing a few drops of oil on the stem occasionally helps reduce wear. On flange-gland stuffing boxes, tighten bolts evenly, as tilting or cocking binds the stem.

New packing contains graphite for lubrication and when the gland is tightened to such an extent that lubrication has been squeezed out there is excessive friction between stem and packing. When the nut is difficult to turn, packing has become dry and hard, or is unsuitable, and should be discarded. This explains why the valve is hard to operate after continued tightening of the gland nut, and why the stem becomes worn until the valve leaks: it wears because of turning in the hard tight packing from which the lubricant has been squeezed.

On regulating valves, excessive tightening to prevent leakage causes friction, which prevents free stem movement, and therefore causes the valve to be erratic —it does not respond to flow changes. Regulating valves equipped with lubricators should have a regular lubrication schedule, with the lubricant recom-

(*Continued on page* 174)

AN *Improved* SIZE 4 STARTER WITH FIVE NEW FEATURES



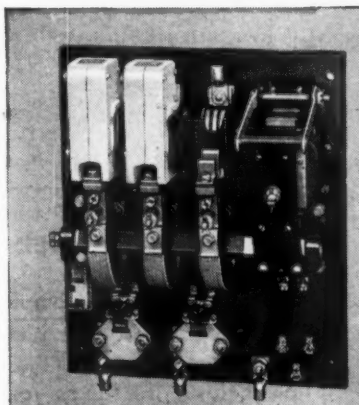
CLASS 8536 · TYPE VG-2

----SMALLER-QUIETER----

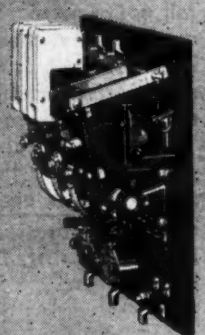
1. Improved blow-out coils have fewer turns and are wound with heavier copper—assuring less heating effect, and efficient interruption of stalled rotor currents for electric motors up to 100 horsepower.
2. New and larger magnet of modified **"E"** type construction gives added efficiency.
3. Self-aligning, floating armature eliminates vibration noise—reduces heating and magnet wear.
4. New shading coil affords exceptional mechanical strength. This coil is held in place by the magnet coil in such a manner as to prevent its falling out. Use of heavy brass ribbon makes shading coil virtually unbreakable.
5. Narrower panel saves space and flat door cabinet permits gang mounting.

• • •

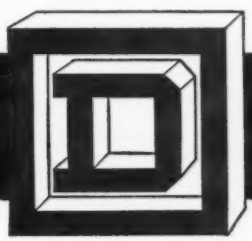
This greatly improved Type V device is available in a complete range of enclosures for all Size 4 starter applications, including reversing, combination, multi-speed, reduced voltage, etc. Call in or write your nearest Square D Field Engineer for complete information.



Open type starter panel with one arc chute removed to reveal contacts and blowout coil.



Side view of panel shows "E" type magnet, floating armature and new shading coil.



SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **WATER COOLING**—Marley Co, 3001 Fairfax Rd, Kansas City, Kansas. 42-page bulletin, entitled *Fundamentals of Water Cooling*, is an aid to engineers and executives in planning or analyzing water-cooling facilities. A review of basic theory in water-cooling engineering is followed by discussions of cooling-tower design and construction, latest trends and refinements, and established good practice.

2 **HEAVY-DUTY HEATERS**— B F Sturtevant Co, Hyde Park, Boston, Mass. 36-page catalog No. 462 gives features, applications, specifications, cross-section and construction details, weights and pressures of Sturtevant heavy-duty heaters.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **REFRIGERATION AND AIR CONDITIONING**—York Corp, York, Pa. Loose-leaf catalog discusses accessories and supplies for refrigeration and air-conditioning plants. Booklet describes ice cans and air fittings, valves and fittings, oil, cold storage doors, renewal parts, etc.

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W 42nd St, New York 18, N. Y.

Write in circle number of item describing one catalog wanted → (17)
Your Company Name Brown Mfg Co
Address 3718 First Avenue
Pottsville, Oklahoma
Your Name John Smith
Your Title Power Engineer
POWER, 330 West 42nd St., New York

ELECTRICAL EQUIPMENT

3 **LOW-REACTANCE DUCT** — Bulldog Electric Products Co., 7610 Jos Campau Ave, Detroit, Mich. 16-page bulletin No. 427-1 deals with the subject of modern bus duct design, as applied to transmission of electric current through feeders at 600 v, or less, ac or dc.

4 **SWITCHGEAR EQUIPMENT** — Bulldog Electric Products Co., 7610 Jos Campau Ave, Detroit, Mich. 90-page catalog No. 441 gives engineering data, list prices, etc, on safety switches, light and power panelboards, switchboards, circuit breaker panelboards and ducts.

5 **PANELBOARD CONVERSION PLAN** —Square D Co, 6060 Rivard St, Detroit 11, Mich. 16-page pamphlet describes a method of converting obsolete and inadequate electric light and power panelboards to full efficiency and modernness without disturbing box or conduit.

6 **PYRANOL CAPACITORS** — General Electric Co, Schenectady, N. Y. 20-page booklet No. GEA-4225, entitled *Engineering Aspects of Pyranol Capacitors in Large Banks*, contains basic principles of system kilovar requirements and supply, application requirements, installations and equipment, and application problems.

MAINTENANCE AND SAFETY EQUIPMENT

7 **LUBRICATING SYSTEMS** — Alemite industrial lubrication div, Stewart-Warner Corp, 1826 Diversey Parkway, Chicago, Ill. Four catalogs discuss the Alemite LubroMeter, Dual Progressive System, Progressive Manifold System and Dual Manifold System of lubrication.

8 **FEED OILERS**—Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis. Bulletin No. 27-A describes Trico modernized line of wick feed oilers, which supply visible, automatic lubrication to solid, wick and waste-packed bearings.

9 **CONSTANT-LEVEL LUBRICATORS** —Oil-Rite Corp, Milwaukee, Wis. Single page leaflet gives construction, operation and installation data on Style J heavy-duty constant-level lubricators.

10 **GRAVITY FEED OILER**—Oil-Rite Corp, Milwaukee, Wis. Single page leaflet discusses construction features of Style DOSF gravity feed oiler, with shut-off and needle valve adjustment.

11 **PLASTIC GOGGLES**—Mine Safety Appliances Co, Braddock, Thomas and Meade St, Pittsburgh 8, Pa. Bulletin No. CE-25 discusses LOOKS goggles for both men and women.

12 **LATHES**—South Bend Lathe Works, South Bend 22, Ind. 8-page catalog No. 150 covers South Bend lathe line. Booklet describes engine, toolroom and precision turret lathes for practically all maintenance, production and toolroom work.

13 **BLOCK SANDER** — National Air Sander, Inc, Rockford, Ill. 4-page booklet presents the new *Mity-Midget* sander. This small lightweight unit operates at high speed and is adapted for fillet and curved-surface work.

14 **LUBRICATION SYSTEM** — Farval Corp, 3248 E 80th St, Cleveland 4, Ohio. 4-page bulletin, entitled *Aloft is No Place for A W O L Bearings*, explains application of Farval Dualine system for sending lubricant under pressure from a central pumping unit to every machine bearing.

METERS AND INSTRUMENTS, MECHANICAL

15 **PROPELLER FLOWMETER** — Builders-Providence, Inc, Providence 1, R. I. 4-page bulletin No. 350 covers the new Propeloflo meter for mainline metering. Flowmeter has many improvements, including streamlined Venturi construction.

(*Continued on page* 170)

FILL OUT AND SEND TODAY! NOT GOOD AFTER NOVEMBER 1, 1944

Write in circle number of item describing one catalog wanted →
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PHYSICAL AND CHEMICAL PROPERTIES OF "dag" COLLOIDAL GRAPHITE

1 Slippery—a Good Lubricant. Softer than talc

2 Conducts Electricity

3 Withstands Temperature Extremes

4 Absorbs, Radiates and Conducts Heat

5 Maximum Purity

6 Low Coefficient of Expansion

7 Particles Bear Like Electric Charges

8 Insoluble in Acids and Alkalies

9 Black and Opaque

10 Gas Adsorbent

11 Little Photoelectric Effect

12 Miscible with Most Fluids

13 Films Adhere Tenaciously and Dry with Sharp Edges

14 Microscopically Fine Particles. Penetrates Fine Pores

15 An Excellent Suspension

Available as a smooth, black, liquid concentrate, Dag colloidal graphite puts a versatile company of physical and chemical properties at your service. Fifteen of the more important of these properties are listed here with a different color given to each for easy reference.

Match these properties by color with the colors on the medals below. Each medal represents a typical performance "citation" to Dag colloidal graphite. Dozens more could be shown, if space permitted, because this product is a dry film, a fluid film, a surface coating, an impregnation—and a few other things besides.

"Mr. Dag"

2 14 13 15

2, 14, 13, 15
CITATION: "Drive belts and other nonconductors traveling at high speed accumulate static charges which under certain conditions may constitute a hazard. This static electricity is controlled and bled-off harmlessly by a Dag colloidal graphite conductive film."

1 3 5 14 15

1, 3, 5, 14, 15
CITATION: "When the work rotating chuck of this large honing machine was assembled and run-in using Dag colloidal graphite, running-in time was reduced approximately 35%, operating temperature dropped considerably, and the danger of bearing damage due to temporary oil film failure was eliminated."

9 13 6 14 15

9, 13, 6, 14, 15
CITATION: "Dag colloidal graphite is used to retouch photograph negatives because of its complete opacity, because a film of minimum thickness is required and because it dries with a sharp edge."

PIN A MEDAL ON YOURSELF!

CHECK THE LIST and pick out those properties which you can use. Then state your problem to us and let our engineers give you the benefit of their experience. It is quite possible that they have already studied a parallel application. You'll pin a medal on yourself for calling in Mr. Dag.

Dag, Oildag, Aquadag, Castordag, Glydag and Prodag are registered trade marks of Acheson Colloids Corporation. Copr. 1944 by Acheson Colloids Corp.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

MIDWEST PIPING & SUPPLY CO., INC.

Announces Acquisition of Control of

THE LUMSDEN & VAN STONE CO.

South Boston, Mass.

PROVIDING ENLARGED AND IMPROVED FACILITIES FOR PIPE FABRICATION AND ERECTION IN NEW ENGLAND

THE Lumsden & Van Stone Company—fabricators and erectors of piping since 1898—has been purchased by Midwest Piping & Supply Co., Inc. As a result, the plant in South Boston has been enlarged, new equipment installed, and the organization expanded. Also available through this subsidiary is the accumulated experience of the nationwide Midwest organization in the fabrication and erection of power and industrial piping for all operating conditions.

MIDWEST PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles
Subsidiary: Lumsden & Van Stone Co., South Boston, Mass.
Sales Offices: New York (Eastern Division)—30 Church St. • Chicago—645 Marquette Bldg.
Los Angeles—520 Anderson St. • Houston—229 Shell Bldg. • Tulsa—533 Mayo Bldg.
Atlanta—Red Rock Bldg. • South Boston—426 First St.

PIPING FABRICATORS AND CONTRACTORS . . . MANUFACTURERS OF WELDING FITTINGS

This is the STEEL VALVE that has –

. . . eye-bolt construction for the packing flange, in all types *including Globes* . . . Gates . . . Angles . . . and in all pressures *including the 150-pound class.*

. . . full-threaded bonnet stud bolts in all pressures *including the 150-pound class*, to achieve equal expansion and contraction.

OIC Cast Steel Valves . . . Gates . . . Globes . . . Angles . . . Checks . . . are available in the 150 and 300-pound pressure classes, with screwed, flanged or butt welding joints.

ARMY E NAVY

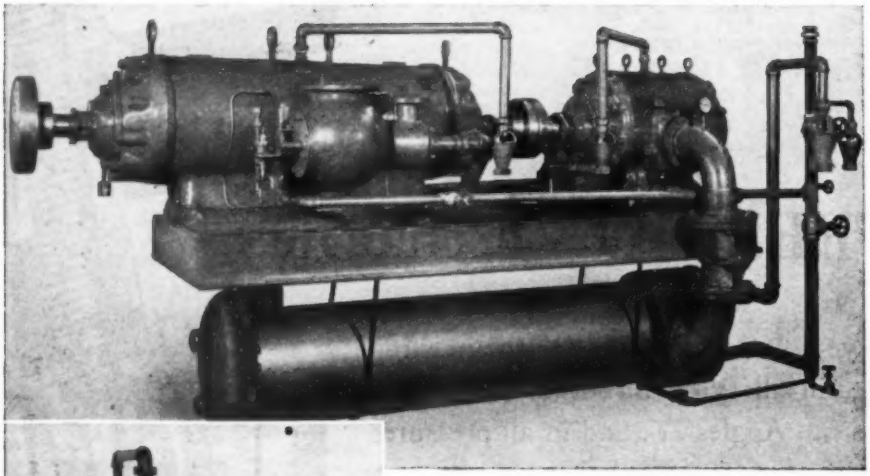
OIC

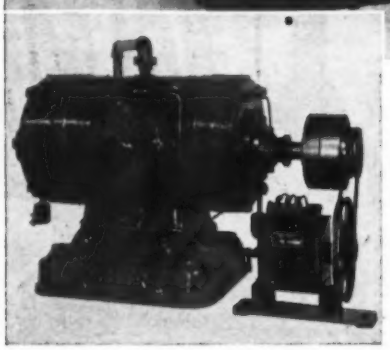
There is an OIC Distributor near you who is ready to demonstrate to you the many superior features of OIC Cast Steel Valves. Call him or write to us for full details.

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

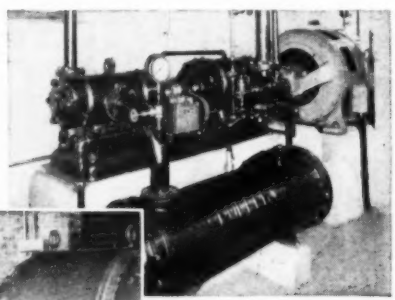
Quality Leaders in Valve Manufacture Since 1883



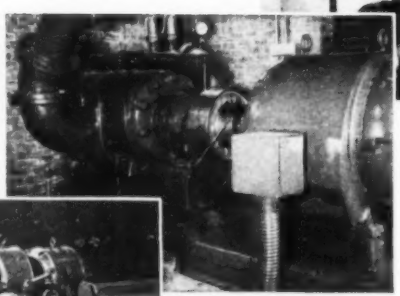


FULLER ROTARY COMPRESSORS

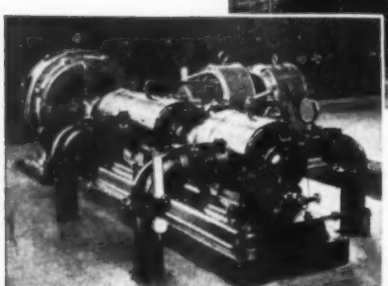
CAPACITIES TO 1800 C. F. M.
ACTUAL FREE-AIR DELIVERY
PRESSURES TO 125-LB.



WRITE FOR BULLETIN C-5.



Foundry: Two-stage compressor. Capacity 330 C. F. M. actual free-air delivery, 100-lb. pressure.



Bulk-cement unloading: Single-stage compressor. Capacity 890 C. F. M. actual free-air delivery, 20-lb. pressure.

Steel mill: Two-stage compressor. Capacity 685 C. F. M. actual free-air delivery, 100-lb. pressure.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago 3 : 1144 Marquette Bldg.
San Francisco 4 : 421 Chancery Bldg.
Washington 5, D. C. : 618 Colorado Bldg.

C-99

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

New Bulletins

(*Continued from page* 168)

16 **HAND AND STATIONARY TACHOMETERS**—Coats Machine Tool Co, Scarsdale, N. Y. 4-page bulletin No. 8485 gives engineering data on triple-range hand tachometers, single-range hand tachometers and heavy-duty stationery tachometers.

17 **INDICATING GAGES** — Metrical Laboratories, Inc, 444 Detroit St, Ann Arbor, Mich. 4-page booklet discusses precision external indicating gages which use air flow as the measuring medium and operate with the Metricator instrument.

18 **CONDUCTIVITY CONTROLLER** — Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 44-page revised catalog No. EN-95 presents the same data about methods of measurement and notes for selection and use of apparatus as did previous edition. In addition, it describes a signalling conductivity controller and several new industrial cells.

19 **pH CONTROL**—LaMotte Chemical Products Co, Towson 4, Baltimore, Md. 84-page revised handbook, entitled *The A B C of pH Control*, covers full line of LaMotte equipment and chemical reagents.

PIPINGS, FITTINGS VALVES AND SPECIALTIES

20 **PIPE FITTINGS**—Tube Turns, Inc, Louisville 1, Ky. 48-page catalog No. 112 covers marine pipe fittings. Section 1 contains dimensional data on seamless wrought steel and wrought iron fittings. Section 2 gives similar coverage to wrought carbon molybdenum alloy steel.

21 SEDIMENT STRAINER—American District Steam Co, N Tonawanda, N. Y. Bulletin No. 89-4 presents the new Adsco Y sediment strainer, which has a working pressure of 125 psi. Sheet also describes the Adsco T sediment strainer.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **WELDING FITTING AND FLANGE CHART**—Tube Turns, Inc, Louisville 1, Ky. Pocket-size dimensional data chart gives layout information on every Tube-Turn welding fitting and flange.

OTHER EQUIPMENT

22 **WATER-TUBE BOILER** — Page Boiler Co, 815 Webster Ave, Chicago 14, Ill. 4-page booklet discusses design, construction and dimension of Page sectional water-tube boiler with water-arch furnace.

23 **WATER-ARCH FURNACE** — Page Boiler Co, 815 Webster Ave, Chicago 14, Ill. 4-page pamphlet describes Johanson water-arch furnace, which makes possible firing of Scotch marine boilers with stokers or other automatic fuel burners at high ratings without smoking.

24 **ELECTRONIC DEVICES** — North American Philips Co, 100 E 42nd St, New York 17, N. Y. 26-page booklet serves as an introduction to company products, particularly electronic devices, and tells what they are doing in the war effort and what they expect to do for industry after the war.

25 **HOT-WATER HEATERS**—Kewanee Boiler Corp, Kewanee, Ill. 4-page catalog No. TW-95c covers Tabasco steel-welded hot water heaters. Diagram gives recommended piping connections to Kewanee storage tank from the Tabasco water heater.

Have You Seen It?

THIS new postwar, general purpose Fairbanks-Morse Motor is available to industry now.

Never before have there been more stamina—more protection—more versatility—built into a motor housing.

You'll have to see it demonstrated to appreciate fully how much this motor can really offer you.

BUY WAR BONDS

Look at These Features!

- ★ It is a 40°C. motor.
- ★ It is a protected motor.
- ★ It has an optional conduit box assembly.
- ★ It has cross-flow ventilation.
- ★ It has ball bearings—sealed-in and protected.
- ★ It has the exclusive Fairbanks-Morse COPPERSPUN ROTOR.

Write for detailed information. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

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MOTORS
GENERATORS
WATER SYSTEMS
SCALES
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FARM EQUIPMENT
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Motors

Two Ground Bronze Seats

GIVE DARTS LONGER LIFE

If Dart Unions wore "hash marks," many now in service would be recognized as veterans of the last war.

Darts don't die on a job. Built with two bronze seats, ground to a true ball joint, they will hold a leak-proof connection for a day or a decade—always ready to move on a moment's notice. That's why "close" buyers like them.

Next time you change piping, change to Darts. When you change piping thereafter, Darts will make the job easier.

Tell your supplier to send you some. They're handy to have in stock when minutes count.

DART UNIONS

E. M. DART MFG. CO., Providence, R. I.

26 FLOOR REPAIR—Flexrock Co, 3677 Filbert St, Philadelphia 4, Pa. Four folders discuss *Instant-Use*, a concrete floor-patching material; *Awog*, a concrete mortar and solution for acid- water- oil-grease-resistant floors; *Rugged-wear*, a floor resurfacer; and other company products.

27 PLASTIC FLOOR COVERING — Truscon Laboratories, Inc, Detroit 11, Mich. 4-page bulletin No. 553 presents *Saf-T-Dek*, a new heavy nonslip plastic coating applied to walking areas.

28 MECHANISM OF WEAR—Nitralloy Corp, 230 Park Ave, New York 17, N. Y. 46-page booklet explains how wear occurs, what factors influence it, and the resistance to wear of various metals and alloys, including Nitrolloy surfaces.

29 INSULATOR TESTER—Herman H Sticht Co, 27 Park Pl, New York 7, N. Y. 12-page bulletin No. 435 describes Model B-5 Megohmer for insulation testing. Booklet shows the triple color scale, various available styles and value of periodic insulation resistance measurements as recorded on Megographs.

30 ENGINE GENERATOR SETS — Caterpillar Tractor Co, Peoria 8, Ill. 20-page booklet No. D-41 discusses Caterpillar line of engine generator sets, tractors, road machinery, etc.

31 WATER TREATMENT—Hungerford & Terry, Inc, Clayton, N. J. Company offers set of booklets on water treatment. Bulletin EE discusses the Edwards exchanger, a cation-anion removal machine for producing deionized water or water comparable with distilled water. Bulletin BFT contains data on zeolite, chemical precipitation, ion exchange and other water treatment processes. Bulletin FF describes *Ferrosand* filter, a machine for iron and manganese salt removal from well water supplies.

32 WELD TESTING MACHINE — Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 16-page booklet No. ADI-889 presents new portable tensile and guided-bend weld testing machine.

33 WELD PROCESS — Metallizing Co of America, 1330 W Congress St, Chicago 7, Ill. 4-page bulletin gives complete information on new *Mogul Nervous Weld Process*, a method of salvaging defective aluminum castings. Booklet contains description of weld pistol and machine. Installation prices are included.

OBITUARIES

Col Warren R Roberts, 81, founder of Roberts and Schaefer Co, Chicago, died June 22 in Miami. He was connected with early Chicago construction in the fields of skyscrapers, river bridges and elevated railway structures. He specialized in structures for the handling and treatment of coal. During 1929-30 he spent considerable time in Russia as engrg consultant on Russia's 5-Year Plan.

Martin V M Symons, 79, died May 2. He was one of POWER's oldest subscribers. For the last 35 years he was chief engineer of the water plant at Danville, Ill.

Chas P Atwood, 89, founder and treasurer of valve and steam specialty mfg, Atwood & Morrill Co, died on June 2.

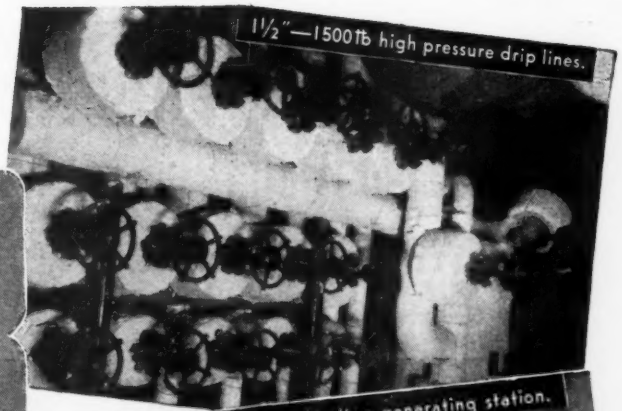
Richard O Muller, former chief engineer, The Terry Steam Turbine Co, died on June 4. He retired from active work several months ago.

Ira D LeFevre, comptroller, General Electric Co, died June 4 in his 61st year.

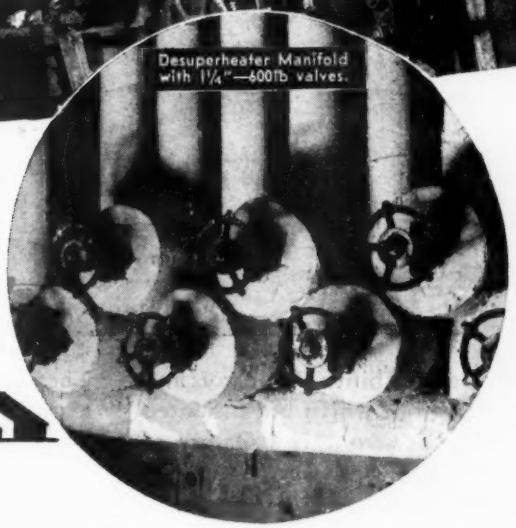
Albert H Armstrong, 73, retired General Electric engineer, died May 31. He had long worked on railroad electrification for his company.

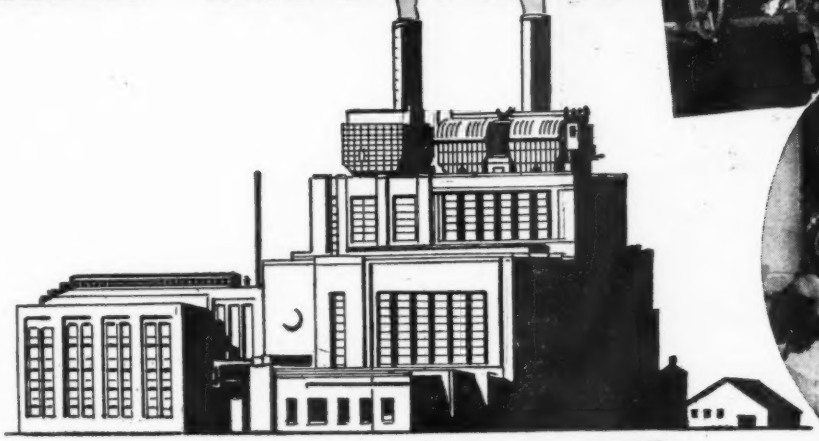
Wm B Cordes, 63, General Electric marine engineer died suddenly on May 29.

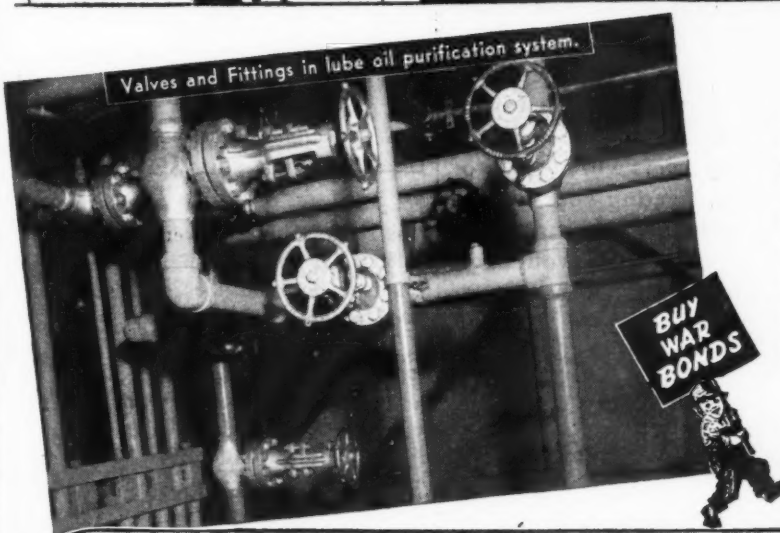
Uninterrupted POWER *for* WAR INDUSTRIES


1½"—1500lb high pressure drip lines.

1"—400lb lines in a leading generating station.


Desuperheater Manifold with 1¼"—600lb valves.




Valves and Fittings in lube oil purification system.

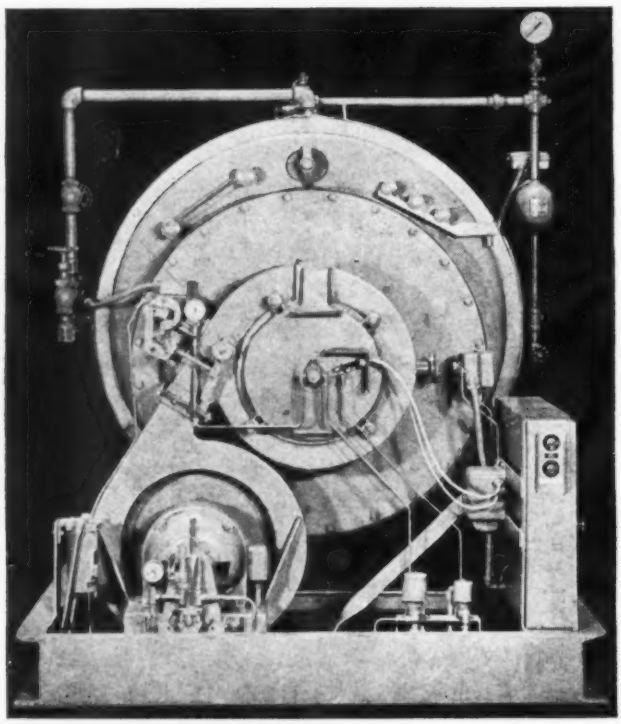
● SAFE and SURE control of vapors and liquids in steam generating plants serving our War Industries is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop Forged Steel* Valves, Fittings, and Flanges made by Vogt continue to play a vital part in the smooth, efficient operations of America's leading power plants.

Catalog F-8 is the *drop forged steel* Valve and Fittings Blue Book.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky
Branch offices: New York, Philadelphia, Cleveland, Chicago, Dallas.

Vogt DROP FORGED STEEL **VALVES, FITTINGS & FLANGES**

DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation



Ready accessibility to controls and gauges, all of which are mounted on the unit's front, is a feature of the 100-horsepower Cyclotherm Steam Generator shown above.

This unit, like all Cyclotherms, operates on exclusive principles of combustion and design that provide high efficiency at low cost of operation.

Cyclotherms are fully automatic and completely self-contained. They are both oil and gas fired in a power range from 10 to 300 horsepower.

Commercial deliveries are being made as rapidly as the press of Government orders permits. If you are planning immediate replacement, our engineers will be glad to cooperate in meeting your needs. We shall be happy to supply any additional information you may desire concerning Cyclotherm.

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 502

ARMY NAVY E

Argument Corner

(*Continued from page* 166)

mended by the valve manufacturer.

When packing a valve with so-called coil packing, it is not necessary to cut it into rings. When winding the packing into the gland press it out toward outer edge of stuffing box, rather than wrap it tight around the stem. After putting in the required number of turns, cut off the packing and draw up the gland evenly with a wrench, then slack off and make it finger-tight.

A split-ring or preformed packing comes with most new valves. If this type replaces worn-out packing, first put a few rings in and tamp into place. Then add sufficient rings (stagger the joints) to fill the stuffing box.

In general, the following materials are recommended for transformer oil service: (1) folded asbestos tape (2) cork cemented with synthetic resin (3) oilproof rubber (4) rubber substitute, such as Duprene. Packing of long fiber asbestos yarns, thoroughly lubricated with a heat-resisting compound and graphite, is recommended for steam or oil; also, for oil, a non-metallic plastic compound containing asbestos fiber, graphite and lubricant binder. Recommended for hot and cold water, steam, gasoline and oil are preformed rings made from a combination of asbestos, powdered aluminum, graphite and neoprene.

Arvida, Que. L A PETRIE

Readers' Problems

(*Continued from page* 112)

was repaired during overhaul, pressure differential now showing on these boilers indicates that these valves are in good order.

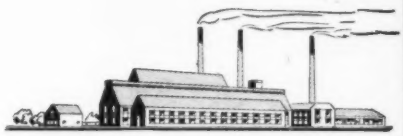
The trouble seems to be unequal firing. I suggest that CRF install a steam-flow meter on each boiler. This indicates whether each boiler is carrying its proportion of the load and enables the fireman to operate accordingly.

Bronx, N. Y. ANTHONY GREER

Overhaul Stoker Control

CRF SHOULD OBTAIN two test gages to connect to No. 2 and 4 boilers and mount beside the main header gage. A

This APEXIOR coating on a plant boiler of a candy factory has been in service for 9 years without renewal. Operating pressure, 250 lbs.



HOW TO PREVENT WAR-STRAINED BOILERS FROM BOGGING DOWN

Under three-shift operation . . . a boiler may be called upon to evaporate three times as much as normally required. This means three years' work in one and because of severe overloads, probably more than three times as much wear.

In hundreds of industrial plants APEXIOR is one of the most important factors today in keeping boilers in service. It not only prevents serious corrosion — thus assuring uninterrupted operation and longer life — but also prevents tight bonding of water scale, extending the length of time between cleaning and making cleaning faster and easier.

Whether or not you have a high priority rating, uninterrupted boiler service justifies every possible safeguard and self-preservation justifies every protection of your boiler.

APEXIOR Prevents Corrosion for 2-3 Years

APEXIOR NUMBER 1 is brush-applied by hand or power coater. It fills in the pores and joints of all hot-wet surfaces, forming an impenetrable barrier against water. There is less adherent scale.

This tough, smooth coating is not affected by high temperatures or ratings, by chemical treatment of boiler water or by varying feedwater conditions. It does not retard heat transfer in operation.

APEXIOR
Easily Renewed

The life of the application varies with the service and wear. It will last 2 or 3 years, often much longer.

Save Materials — Man Power

Apexiorize your boilers. Keep the metal young. Avoid damage and wasted man power that cannot be measured in dollars.

Write for Bulletin 1290 containing facts on a paint that fortifies metal against the ravages of war schedules.

Users like these have applied APEXIOR for years

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Portland General Electric Co.

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Socony Paint Products Co.

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The Stanley Works

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American Viscose Corp.

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A Peacetime Plus ★ ★ ★ A Wartime Must

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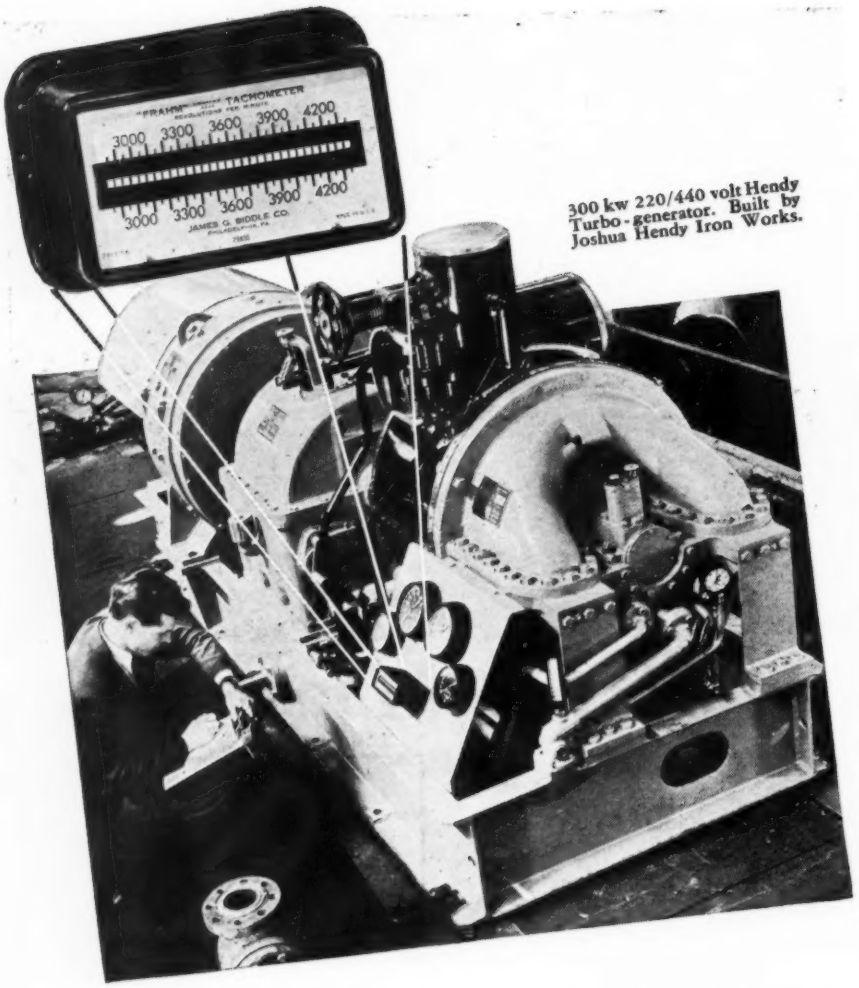


300 kw 220/440 volt Hendy Turbo-generator. Built by Joshua Hendy Iron Works.

. . . making **"ASSURANCE DOUBLY SURE"**

***with the* "FRAHM" RESONANT-REED TACHOMETER**

In the modern turbo-generator, uniformity of speed must be maintained over the entire range of no-load to overload conditions.

The Hendy unit shown above has a carefully designed and precisely built governor to assure uniform speed under widely varying load conditions. As a double check, however, Frahm Resonant Reed Tachometers are used on Hendy and other well-known turbo-generators, both large and small, to provide the operator with constant proof of turbine speed. Manufacturers select Frahm instruments for this service because of their simplicity of construction, ease of installation and freedom from maintenance.

Frahm Tachometers are built in both stationary and portable types for use on many kinds of machines having rotating parts. Various ranges are available from 900 to 60,000 r.p.m.

For a complete description of Frahm Tachometers together with list of types and ranges commonly supplied, write for Bulletin 1590-P. The instrument shown above is listed in Bulletin 1740-P.

JAMES G. BIDDLE CO. 1211-13 ARCH ST. PHILADELPHIA 7, PA.

(567a)

3-pen pressure recorder would be even better.

I think he will find the trouble in the automatic control on the stokers. It may be only a coincidence that trouble started just after No. 2 boiler was overhauled. It may now be more sensitive to changes in firing thereby causing the stoker control to cycle. The controller could be easily overhauled and adjusted to eliminate this pressure variation.

Charleston, W. Va. ARNOLD O'DELL

Caused by Unequal Firing

STUDY OF THE THREE SETS of pressure readings shows that the discrepancies are caused by unequal firing between the hand- and stoker-fired boilers. Thus, in one instance No. 4 boiler supplies no steam whatever, since its pressure is less than header pressure, indicating that No. 2 is over-fired. In the other instance, however, No. 4 supplies all the steam, a condition that exists only when No. 2 fire is low, or when starting up.

Of course, difference in pressure between the boiler and main steam gage is caused by a frictional drop that exists in all pipes carrying fluid.

Saugus, Mass. A J WESOLOWSKI

Answers to June Question 2— What Is Finger Tight?

(*Continued from page* 113)

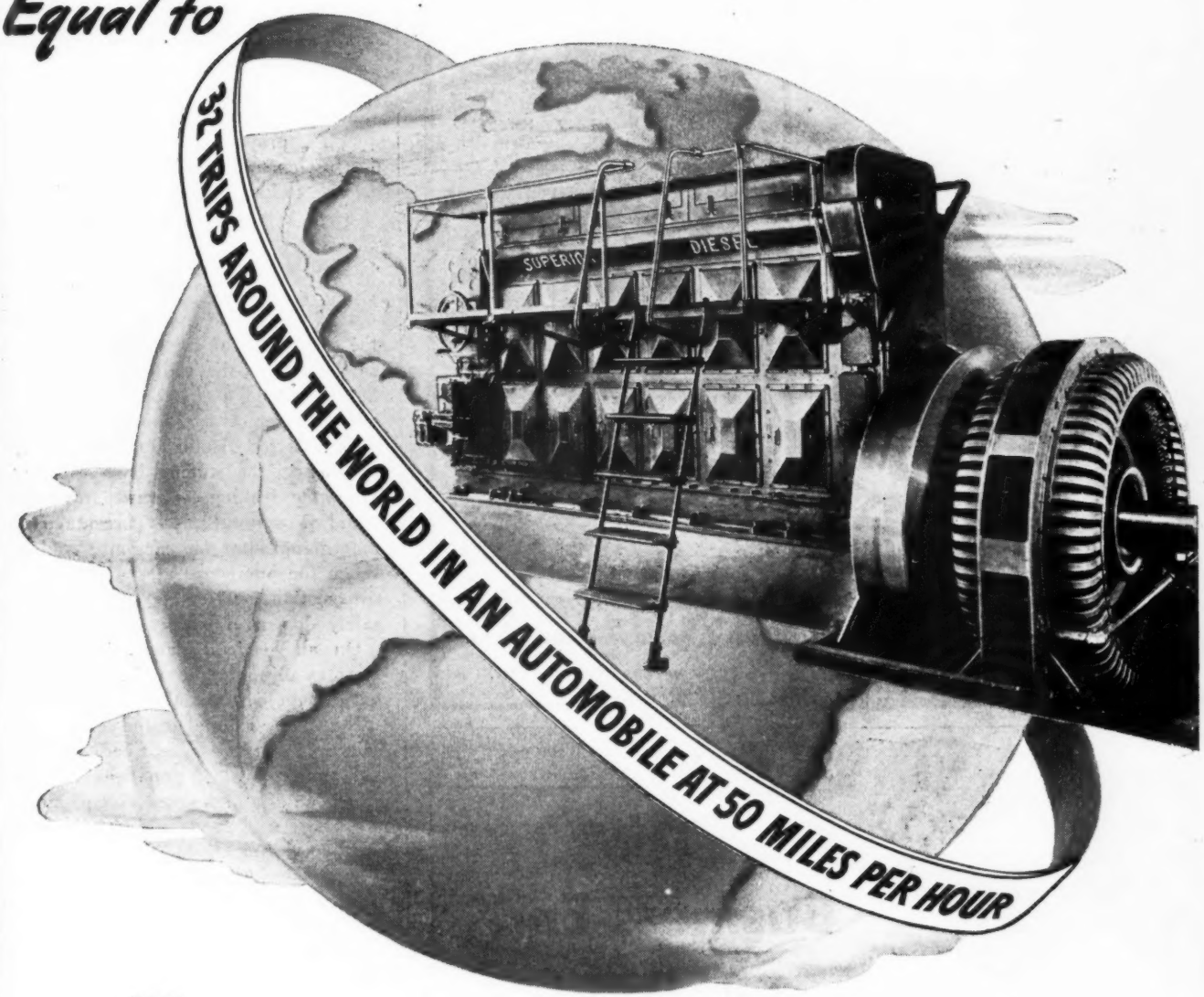
into place with a wrench, while rotating the shaft or moving the rod back and forth slowly. It is essential that packing rings be firmly seated, especially those at the bottom of the stuffing box.

In some ways packing is like a bearing; it must be lubricated and/or cooled to prevent overheating. Initial lubricant will not last forever and must be supplemented by additional lubricant or, as is more common, a slight leakage allowed—10 to 30 drops per minute; 10 gal per day is generally excessive. In other words, keep packing tight enough, by finger or wrench, to maintain leakage at a minimum without overheating the packing.

Lantern rings are often used merely because they were furnished with the pump. Ordinarily, where the liquid pressure exerted against the packing is above atmospheric, a ring is not required, except when necessary to feed lubricant or seal liquid. When a lantern ring is used because of lubrication or seal liquid requirements, locate it about one third the way out from the

A SUPERIOR DIESEL WAS "TORTURE TESTED" FOR 5,160 HOURS . . .

Equal to



We of the Superior engine plant in Springfield, Ohio, are perfectly aware that there is no such thing as a perfect engine. The Superior Diesel we make is a fine engine that has proven its worth and ruggedness in thousands of power installations all over the world. These are simple facts of which we are proud, but it is not our intention to rest on our laurels.

A recent test run of 5,160 hours made on a Superior Diesel in our laboratory is typical of our research efforts to make an even finer engine. During this particular test standard parts were tested against newer developments and at one point the oil flow was intentionally cut off and the bearings deliberately burned out. This was done to determine the effect that burned out bearings would have on the crankshaft. The answer to this was that the crankshaft was unaffected. During the 5,160 hours this engine was tested, it developed an almost continuous rate of 150 horsepower for a total of 774,000 horsepower hours. The data gathered as a result of this and similar tests is your guarantee that the Superior engine you buy is the finest power investment you can possibly make today or tomorrow.

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Factory: Springfield, Ohio.

Superior **DIESELS** • STATIONARY, 31 to 1160 H. P. MARINE, 28 to 1160 H. P. • GENERATOR SETS, 12½ to 770 kw.

ADAMANT
FIRE BRICK CEMENT

IT'S S-M-O-O-T-H-E-R . . . BECAUSE IT'S A-I-R F-L-O-A-T-E-D

"Air-Floating" . . . one step in the manufacture of Adamant drops out the larger, coarser particles and leaves only the basis for a finer, smoother cement. So uniformly smooth is Adamant that it permits the highly desirable thin joints that weld the brick together . . . joints as strong as the brick they bond.

Use Adamant for longer lasting linings in boiler furnaces, forging and heat treating furnaces. Reduce maintenance and rebuilding costs. Adamant is one of an extensive line of Ada-products . . . a refractory for every purpose. Write for literature and name of nearest dealer.

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THE Frederick IRON & STEEL CO.
Frederick, Maryland

Send for Explanatory Bulletin and Look Into This

bottom of the stuffing box. When used to prevent air entering the casing, locate it about one third the way in from outside end of stuffing box.

Port Arthur, Tex. T H POWER

Use Cotter Pins in Studs

THE TERM FINGER TIGHT should not be taken too literally. When a centrifugal pump is properly packed there should be just enough leakage coming to the outside to keep the shaft cool and thus provide a seal against pulling in air. It is not necessary to have the equivalent of a fountain spray around the pump.

If the lantern ring were placed at the outer end of the stuffing box, as LCR suggests, the sealing water would naturally tend to flow out in too great amount against atmospheric pressure. This calls for placing the lantern ring midway in the stuffing box. Amount of water leaking outward from the gland is only a small percentage of that going into the suction chamber. When the pump operates with a positive suction head, gland seals can be safely dispensed with.

On all vertical glands, insert cotter pins through the studs, so that, if nuts loosen back unnoticed, the follower still remains entered in the box. This calls to mind one case where the 1-p follower dropped off unnoticed and the crosshead of a high-speed unit pounded the gland and studs until they were worthless.

When slacking off on the nuts, there is often doubt about how far a follower may be loosened before it is entirely out of the box. A good precaution is to scribe a number of rings around it or simply make a few center-punch marks and number them progressively to indicate how far the follower is inserted.

When installing new packing, press the first rings firmly to the bottom of the stuffing box. Too often, glands are packed in a haphazard manner without removing all the old packing and with the new rings hastily fitted on top. Be certain the stuffing box is empty and clean before refilling.

Kearny, N. J. GEORGE MCNALLY

CORRECTION

In "Classify Your Power Costs," page 99, June *Power*: In table 2, the item "Total Annual Cost of Power" should read 3.8 c per *useful* kwhr instead of 3.1 c.

B J George

Locomotive "No. 1," which puffed its way across the dales of mid-Wisconsin in 1851, was one of the trail blazers for the present magnificent transcontinental system of the Milwaukee Road.

Movement of vital war freight was speeded and tonnage increased when the Milwaukee Railroad installed General Motors Diesel Locomotives on the 225-mile mountain zone between Avery, Idaho, and Othello, Washington.

PATTERN FOR FINER TRANSPORTATION

WRITTEN into the grueling war job the railroads of America are doing, is the story of this mighty titan of the rails. This is the General Motors Diesel Locomotive. It is displaying the unusual stamina, speed and willingness to work ceaselessly which these urgent times demand. And with such tireless, low-cost, swift service these GM Diesel Locomotives are providing a pattern for finer transportation in the greater days to come.

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KEEP AMERICA STRONG
BUY MORE WAR BONDS
★

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GENERAL MOTORS
DIESEL POWER

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ENGINES . . 150 to 2000 H.P. . . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio

ENGINES . . . 15 to 250 H.P. . . . . DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.

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- Cadmium Plated Inside and Out
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See Your Supply House or Send for Bulletin S-200

YARNALL-WARING COMPANY
100 Mermaid Avenue PHILADELPHIA 18, PA.

YARWAY STRAINERS

Power News

(*Continued from page* 130)

Barret, Jamestown. Charles Elder presented the new president, Frank Smart with a gavel that he had made from a piece of wood taken from a black walnut tree 600 yr old. This tree was felled by a cyclone in 1920 on the Niagara Indian reservation.

COAL POINTERS

National Assn of Purchasing Agents issued five coal information forms for steam boiler plants. Now they add a sixth form, analyzing information on the other forms, giving boiler-plant fuel limitations, and showing the field in which coal may be selected.

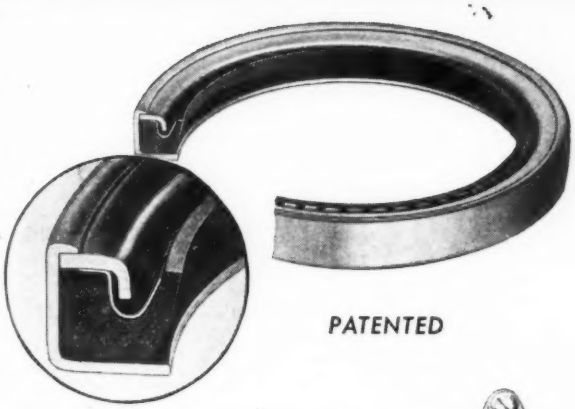
Deputy Solid Fuels Adm Potter, who recommended the form, urges all companies operating coal-burning steam generators to compile such information and have it available when conservation engineers arrive. He is sending the latter to power plants to improve economy and coal saving and they are expected to use the sixth form. Apply to Natl Assn of Purchasing Agents, 11 Park Place, New York, N. Y., for a specimen, which may be reproduced.

Extensive educational programs of power engineers for conservation of fuels and other products are saving the nation substantial amounts of its natural resources, according to Clyde A Bland, pres, Natl Assn of Power Engineers.

Coal Age, McGraw-Hill publication, announced two "Coal for Victory" awards to be presented, with Solid Fuels Adm support and cooperation, to mines or collieries, which have a WPB serial number and which operated in 1943-44. The awards are to be both a stimulus to war production, fixed this year at a record-breaking 691,000,000 tons, and as recognition of the industry's war effort. Qualifying mines will receive either the "Victory Production Award" or the "War Production Efficiency Award," or both. The 691,000,000 tons needed for this year is 82,000,000 tons more than in 1940, last prewar year. In addition, the industry is asked to make this record with about 80,000 fewer employes than in 1940.

Anthracite movements into New England in 1944, through May 20, totaled 2,859,119 tons, or 3.8% more than in the comparable 1943 period. Bituminous coal to New England in 1944, through May 20, was 10,306,977 tons, or 1.2% more than the 1943 period.

Coal forwardings into Washington and Oregon, week ending May 20 were 54,630 tons, or 1845 tons less than May 13 week. Coal into these two States through May 20 was 1,377,405 tons, or 97,785 more than in the same 1943 period. Mounting war and industrial coal requirements in the Northwestern States make it imperative that do-



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On Every Front

GARLOCK Packings, Gaskets and KLOZURE Oil Seals are helping to keep production running at top speed in war plants and essential civilian industries on the home front. Also they are giving dependable service on our many battle fronts—on warships, landing barges, tanks, bombers and fighter planes—for a quicker end to this war of aggression.

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In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.

GARLOCK

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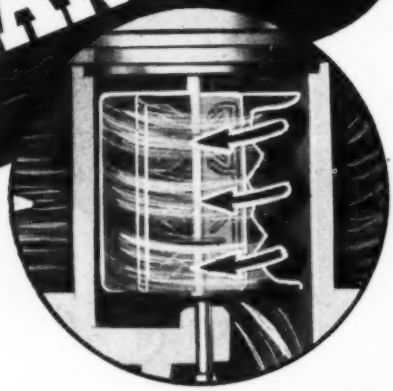

in the

HENSZEY *Feed Water* METER

The abrasive action of hot, dirty Boiler Blowdown quickly breaks down meters that depend upon close clearances for their accuracy. That's why the Henszey meter is the choice of so many Power Plant Engineers for the Boiler Blowdown measuring chore.

Henszey meters stay accurate—stay on the job—accurately measuring Boiler Blowdown, Feed Water, Condensate, Free-running Chemicals and other "hard to measure" liquids.

Sizes from 10 g.p.m. to 1200 g.p.m. cold water steady flow rating. Pipe connection ¾" to 6" —special sizes to order.

If you have a particularly tough liquid measuring problem send us the details — maybe a Henszey Feed Water Meter can do the job where other meters have failed.

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FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Flow Indicators • Boiler Feed Regulators • Proportioning Valves

domestic consumers increase storage supplies now while coal for stocking is available, Administrator Ickes said.

Buckwheat No. 2 (rice) size of anthracite is under the limitation for domestic use applicable to larger sizes of hard coal, effective June 2. Other important changes in equitable distribution of Pa. anthracite include: (1) provision for variation in monthly shipments of both buckwheat No. 1 and 2 to retailers, depending upon their storage capacities (2) further restriction on anthracite shipped for industrial use, to a 3-month supply (3) relief for dealers, normally supplied by truck from the mines, who are suffering from truck shortages, by permitting them to be supplied by alternative transportation.

IN CANADA

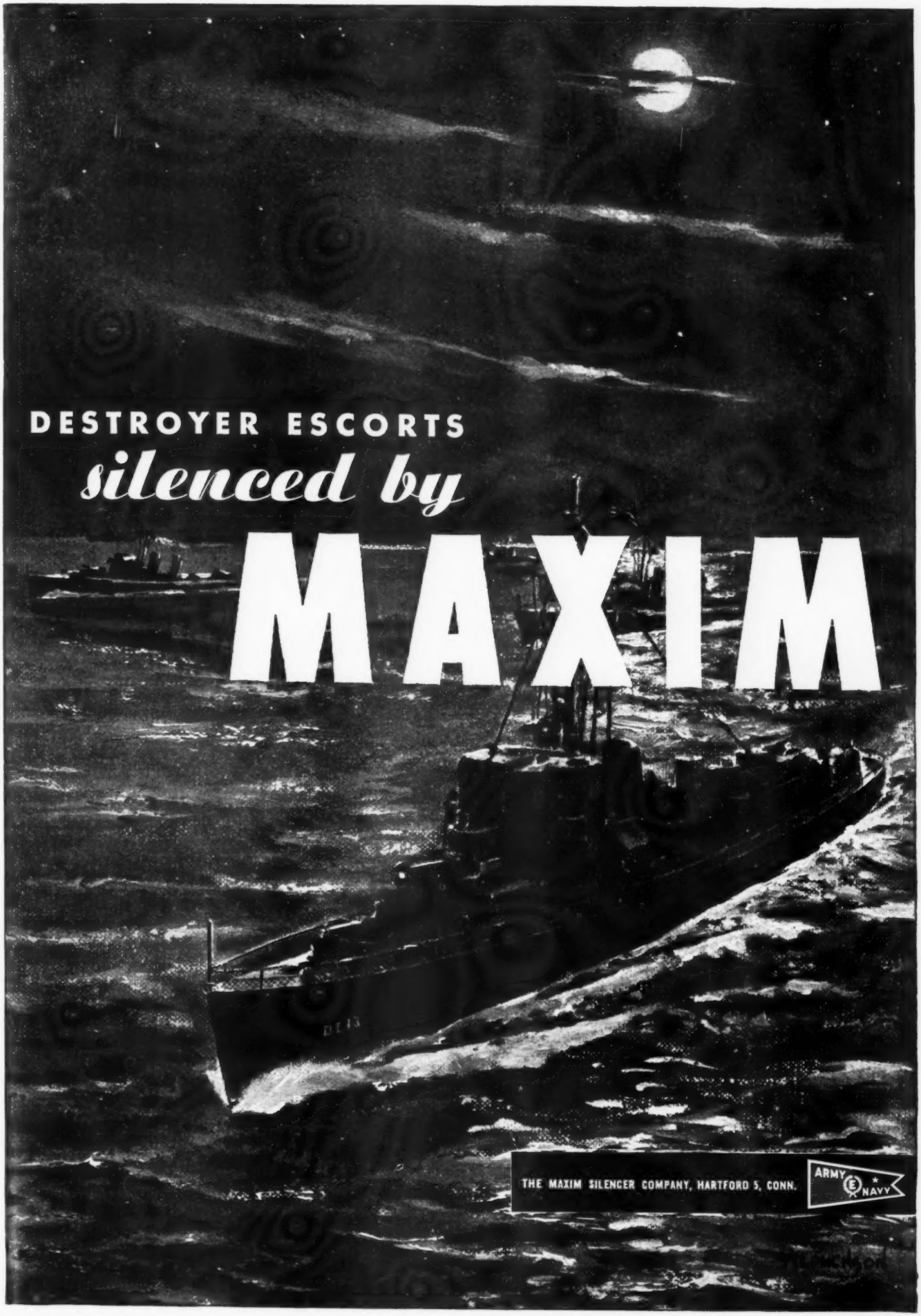
A water-power study, by C E Webb, district chief engr, British Columbia Dept of Mines and Resources, surveys and engrg branch of Dominion Water and Power Bureau, gives extremely interesting figures. On undeveloped water power, latest figures indicate that B. C. has an estimated 7,023,000 hp at ordinary minimum flow and 10,998,000 avaliable for six months of the year. All power estimates are based on continuous 24-hr power at 80% efficiency. B. C. ranks second only to Quebec.

Some important potential power sites on the Fraser River and tributaries include the following hp: Lillooet, 370,000; Moran, 1,320,000; Soda Creek, 310,000; Chilko-Taseko Rivers to Bute Inlet, 800,000; Eutsuk Lake to Kimsquit River, Dean Channel, 910,000; Tahtsa Lake to Kemano River, Gardener Channel, 845,000; Bridge River, 355,000; Quesnel River, 100,000. On other large rivers, such as the Campbell, Nass, Skeena, Columbia, Kootenay, Pend d'Oreille and their chief tributaries, are many favorable medium head sites of great potential value.

Electric power is at a premium in the Vancouver district because of low-storage lake-water levels and sharply increased consumption. Says W G Murrin, pres, B. C. Electric Railway Co, winter snowfalls and spring rains throughout B. C. have been lightest in years and unless immediate steps ease the present drain on storage lakes, the situation will be serious by Sept. In that event, arangements have been made to draw on power from Washington state, but that state also is suffering from lack of precipitation and is contending with a shortage.

The big Brilliant, B. C., project, to cost eventually $9,250,000, was expected to deliver power in May to Consolidated Mining & Smelting Co. Two 35,000-hp units operate first, two more when demand increases. The new dam is the fourth on the Kootenay River near Brilliant.

Manitoba power commission achieved the largest net revenue in its history in 1943, being approximately $1,865,808—an increase of $161,879 over the previous year. Estimated net revenue after all fixed charges were paid—$344,712.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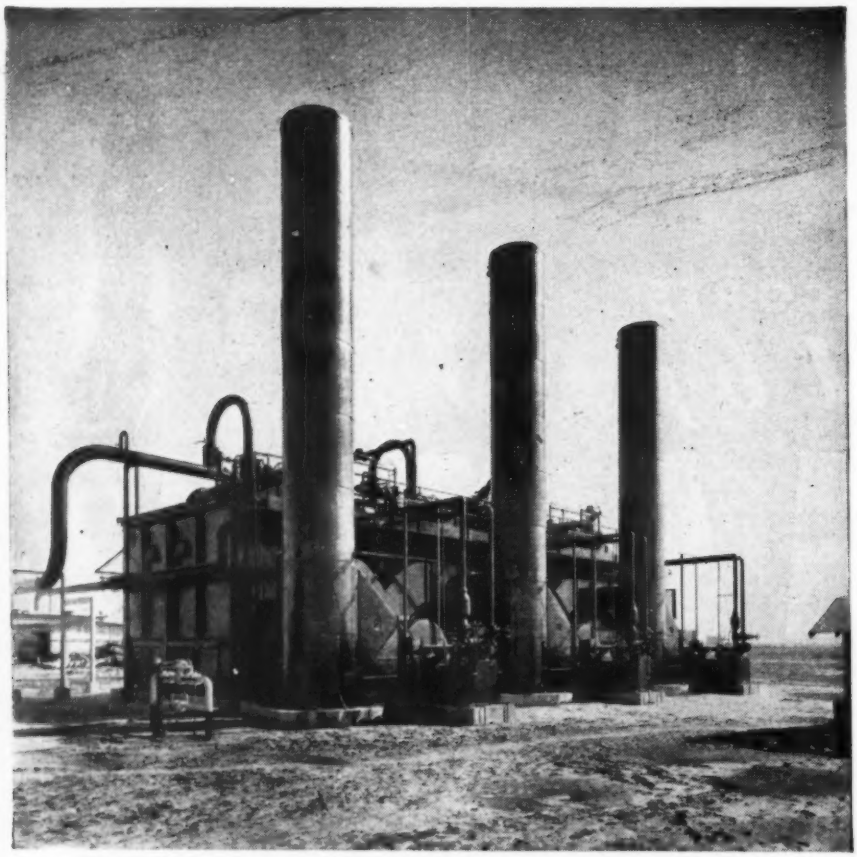

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3 UNION—"H"—Type Steam Generators With Self Contained Water Cooled Furnaces and Steel Cased Settings.

Selected by The Hudson Engineering Corporation for Continuous Dependable Service.

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BOILERS

PRESSURE VESSELS • PLATE FABRICATION

Questions and Answers

(*Continued from page* 118)

A—Fig. 11 shows a side view. In this stoker, coal flows by gravity from a hopper onto a dead plate and is fed from there to the grate by a reciprocating pusher. The grate is steeply inclined, and each separate bar has a rocking motion that gradually works the coal down to the bottom of grate. Ashes pass onto a dumping grate and are dumped at intervals into an ash hopper. The grate bars and pusher feed plate are operated by an eccentric, and the eccentric shaft is driven by an electric motor or small steam engine.

Q 17—Describe the operation of an underfeed stoker.

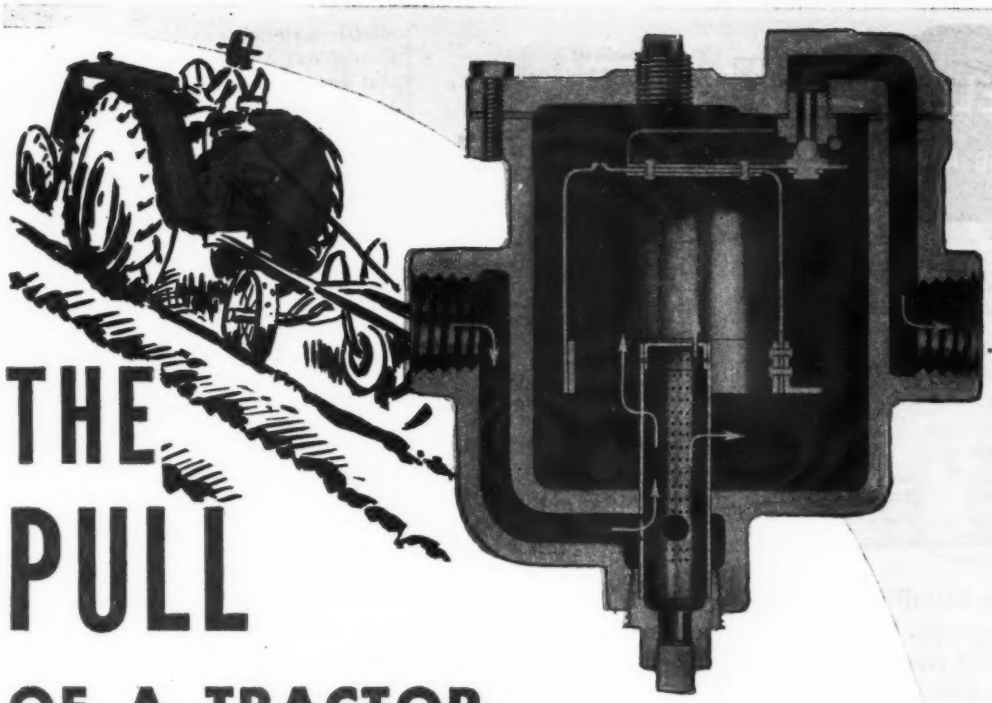
A—There are a great many different types of underfeed stokers, but practically all operate on the principle in Fig. 12, which shows a sectional view of a forced-draft single-retort underfeed stoker: Coal from a feed hopper is pushed forward into a deep central retort by a power-driven ram and distributed the full length of the retort by auxiliary pushers. The coal spills over the sides of the retort onto inclined side grates, some of which have a reciprocating motion that feeds the coal slowly downward onto dump plates. They are tilted at intervals to deposit ashes in ashpits or ash hoppers. Ashes are removed through doors in the stoker front or, if hoppers are used, discharged into ash cars or conveyors.

The gate bars are hollow, and some of the air for combustion is admitted to the fire through openings in the grate bars at the point of distillation of the gases, that is, just above the fresh green fuel being fed in at the bottom of the retort. The rest of the air passes through the hollow grate bars to auxiliary windboxes at the lower ends of the grates and is distributed from the boxes up through the fire bars to the fuel on the grates. Air may also be admitted over the fire to assist combustion and prevent smoke.

Fig. 13 is a side view of a multiple retort underfeed stoker. It has a number of narrow retorts with narrow grates between. The main grates slope quite steeply from front to rear and the coal feeds downward to a short grate with reciprocating bars that carry the ashes onto a dump plate. It is tilted periodically by hand or power and the ashes deposited in an ashpit or hopper. As in the center-retort stoker, power-operated rams feed the coal into the retorts from beneath the grate and forced draft distributes the air for combustion through the fuel bed.

Licenses under the Leduc and Dufour patents, covering application of high frequency heating in the production, processing and manufacture of rubber, plastics, wood and other products, are now available in this country. B F Goodrich Co, Akron, O., will issue licenses covering rubber applications; H H Giodvad Grell, New York City, will issue licenses in all other fields.

Main technical advantage of the processes and apparatus is that non-metallic di-



THE PULL OF A TRACTOR

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The Sarco BUCKET STEAM TRAP

for

STEAM MAINS

PROCESS STEAM LINES

KETTLES AND PANS

TANKS

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EVAPORATORS

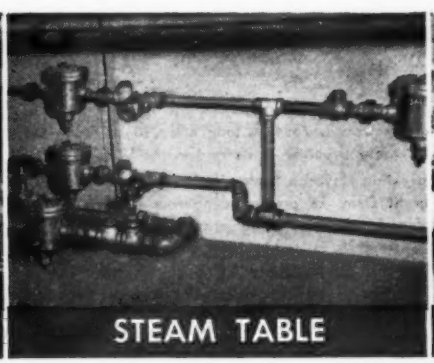
For sheer capacity, the Sarco Bucket Trap can outhaul any other type in terms of condensate delivered. It will take the toughest load of a laundry or platen press in its stride. On busy supply lines to engines, turbines, pumps, and refinery equipment, it removes all condensation as fast as formed, assuring dry steam to the equipment.

Five outstanding advantages:

1. Straight-through connection saves piping.
2. Cleaned without disconnecting.
3. Strainer is included inside the trap — saving the cost of separate strainer installation.
4. Can be equipped with thermostatic air by-pass.
5. Made in three standard ranges up to 250 lbs., and in special types of forged steel up to 900 lbs.

Ask for Catalog No. 350.

STORAGE TANK



STEAM TABLE

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SARCO Saves Steam

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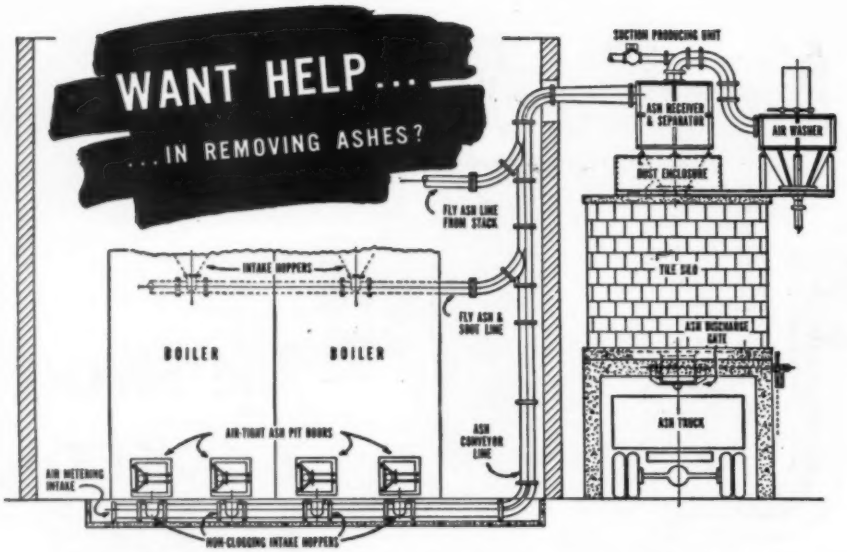

Get the help you need by installing a Beaumont Birch "Vac-Veyor" pneumatic ash handling system. Labor is saved; cleanliness effected. System time-tested. Low first cost. Low operating cost. Installation as flexible as running a pipe line. Minimum critical materials required. Two sizes, two types—for delivering ashes either dry or damp.

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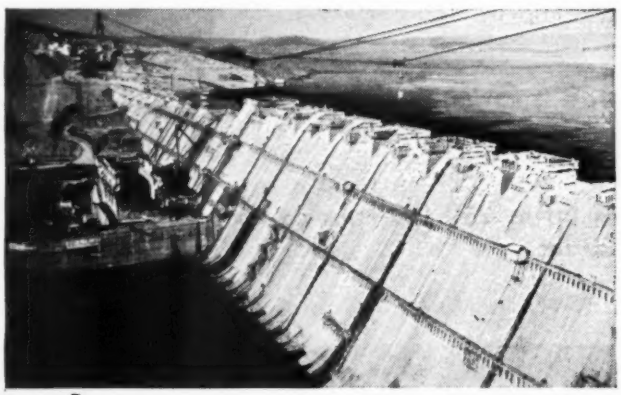


Another Great Dam Benefits from FRICK Engineering and

TRADE FRICK MARK

Refrigeration

Stretching across the North Fork of the White River, in Arkansas, Norfork Dam is 2624 ft. long and 220 ft. high—the fifth largest concrete structure of its kind in the U. S.

Frick Refrigeration played a triple rôle in hastening the building of this great Dam. To prevent dangerous heating as the concrete hardened, the water going into the mixers was chilled almost to the freezing point; in very hot weather, tons of crushed ice were also supplied; after being poured, the monolith was cooled for months by circulating chilled water through 900,000 ft. of pipe imbedded in the mass.

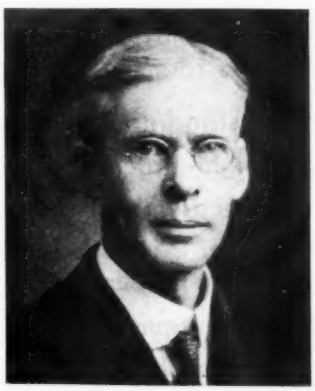
Frick Engineering and Frick Equipment served with distinction on this big project. Which leads us to repeat: "For the really important jobs, specify Frick Refrigeration."

FRICK CO., WAYNESBORO, PENNA.

electric materials can be *rapidly* and *uniformly* heated *throughout* their mass, and that temperature and temperature rise can be accurately controlled. This high-frequency heating process, which the inventors originally developed to overcome the difficulties inherent in vulcanization of massive rubber objects, has made possible heat transfer in many poorly conducting or non-conducting materials.

WPB's aluminum div has ordered a shutdown in four aluminum potlines at the Maspeth, L. I., plant, owned by the Defense Plant Corp and operated by the Aluminum Co of America. Coal savings, which will result from the shutdown, are estimated at 720,000 tons yearly, according to a WPB official who said each line had been producing 3,000,000 lb of aluminum per month.

Professor R W Angus, head of University of Toronto's dept of mechanical engrg, will retire at the close of this academic session. Internationally known for his work in hydraulics, he has written many technical papers and two textbooks. He pioneered in the use of models for the study of water flow and elimination of ice troubles in hydraulic plants. In 1942 he won the American Water Works Assn's George Warren Fuller Award.



Professor R W Angus

Gas turbines as power source. W F Boyle, newly appointed manager of gas-turbine activities, steam div, Westinghouse Elec & Mfg Co, predicts the first postwar commercial use of the gas turbine will probably be providing power for locomotives. Later gas-turbine applications, in the probable order of appearance, will be for aircraft drive, ocean ship drive, industrial power, and finally electric power generation.

The gas turbine applied to driving locomotives will yield considerably more power than is attainable with present steam machinery, and will do it with twice the efficiency. Thus the gas turbine is even now, although still in an early stage of development, an economically advantageous power source for the important job of rail transportation.

Mr. Boyle has been with the steam div and the Middle Atlantic sales district of Westinghouse as manager, marine section, steam div application dept, and before that as manager, the div's sub-contracting dept.

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 6

New Booklet Tells How To Get Most Out Of Tubes

Scovill's "Condenser Tube Booklet" has important facts for operators of condensers and heat exchangers

Here are 56 pages of useful information on many of the important factors relating to condenser and heat exchanger tubes. Among the subjects covered are:

Tube Corrosion: types (with characteristic specimens illustrated in natural color), causes and methods of protection

Selection of Tube Material

Composition and Properties of Tube Alloys and Common Metals

Installation Methods

Specifications

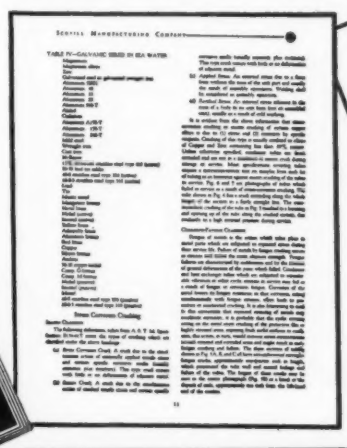
Methods of Production

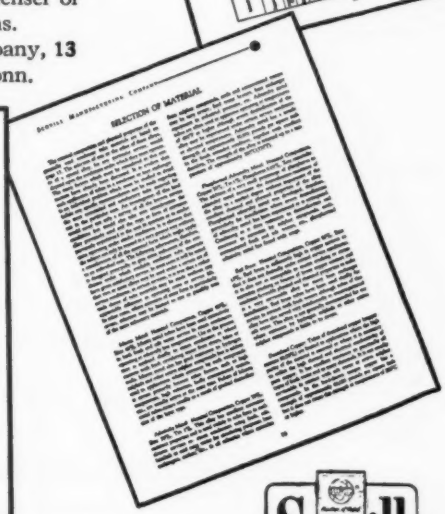
Also included are discussions of the extrusion process and the hot piercing process, and such useful data tables as those on gauge sizes, conversion factors, formulas and physical constants, etc.

THIS BOOKLET ILLUSTRATES 1 OF 3 SCOVILL SERVICES

Scovill considers that its responsibility to power plant operators, embraces not only tube *manufacturing*, but also *information* and *service*. Information such as is found in the new "Condenser Tube Booklet" is part of Scovill's *Service in Manuals*. A second service is *Service in Metals*, which includes the development of new or improved tube alloys and the analysis of problems arising from tubes in service. The third Scovill service, *Service in Men*, makes Scovill's technical experience available through individual recommendations for specific requirements — helping you obtain maximum efficiency from your condenser or heat exchanger tube installations.

Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn.





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WATERBURY, CONN.

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Service in Manuals... Service in Metals... Service in Men

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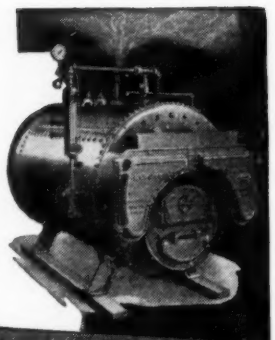
SCOTTIE JR BOILER

5 sizes for small industrial usage. 9.9 to 30 H.P. Conveniently compact, yet easily accessible. Low in cost—economical to operate.

75 Years Boilermakers



For 6" scale with pipe diameter marking, write Department 99-K8.

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High Pressure Steam at Low Cost

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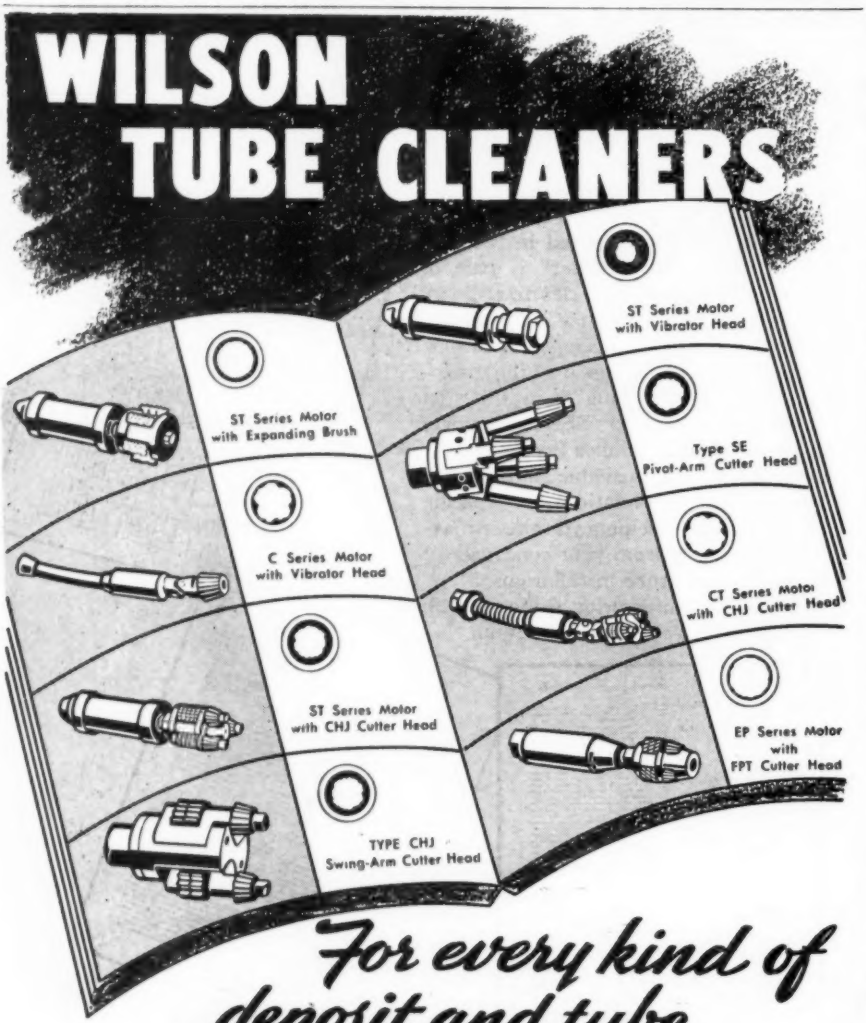
WILSON TUBE CLEANERS


ST Series Motor with Vibrator Head
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Fast, powerful tube cleaners for every type of power boiler and condenser tube—for all types of deposits — cuts cleaning time and expenses to a minimum.

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APPOINTMENTS

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American Chimney Corp, New York, N. Y.
Beaumont Birch Co, Philadelphia, Pa.
Bigelow Co, New Haven, Conn.
Clark Bros Co, Inc, Olean, N. Y.
Pacific Pump Wks, Huntington Park, Calif.
Phillips Cooling Tower Co, New York
Schaub Engrg Co, Chicago, Ill.
Skinner Engine Co, Erie, Pa.
American Marsh Pumps, Inc, Battle Creek
Electric Machinery Mfg Co, Minneapolis
Elgin Softener Corp, Elgin, Ill.
Flori Pipe Co, St. Louis, Mo.
Fly Ash Arrestor Corp, Birmingham, Ala.
Hahn Eng Div, Luria Steel & Trading Corp, New York, N. Y.
Hoffman Combustion Engrg Co, Detroit
Ludeman Du-Al Valves, New York
Murray Iron Works, Burlington, Iowa
Schade Valve Mfg Co, Philadelphia, Pa.
Sutorbilt Corp, Los Angeles, Calif.
Thomas Foundries, Birmingham, Ala.
Wright Austin Co, Detroit, Mich.

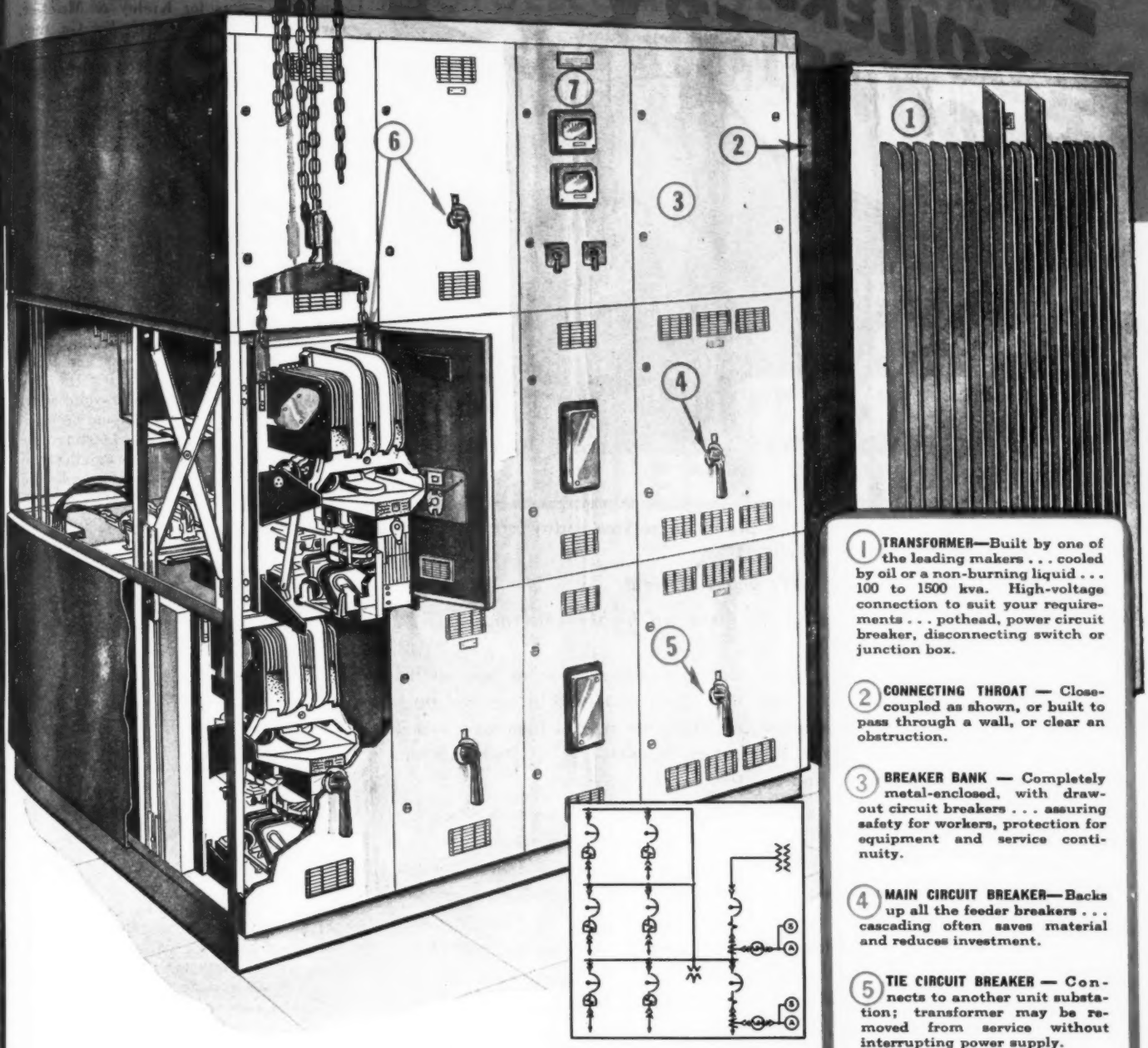
General Controls new branch offices are: 687 Boylston St, Boston 6, Mass., with **Wm Marsh** as mgr; 1505 Broadway, Cleveland, O., with **L E Wetzel** in charge. . . . **Sylvania Electric Products, Inc,** has added to the adv staff of the radio div, **Richard G Mackey,** as editor of *Sylvania News*. . . . **Leroy Camel** has been appointed sales mgr of the Alkali div, **Detrex Corp.** Detrex N. Y. region headquarters are in the Empire State Bldg, **Stanley A Harris** mgr. Their Philadelphia office has moved to 12 S Twelfth St, **Wayne Gaddy** in charge. They have opened a new office in Indianapolis at 11 So Meridian St, **Chas M Munns** mgr.

Dean C Ober was elected vice-pres, **The Cleveland Electric Illuminating Co.** . . **C Swain Lumley** has rejoined the engrg staff of **Smith, Hinchman and Grylls, Inc,** as industrial engrg mgr . . .**J K Gannet,** vice-pres, **The Austin Co,** who was recently appointed director of engrg and research, is now a director of the company . . . **The Superheater Co,** of Montreal, announces the following elections: F A Schaff, chairman of the Board; C A Odell, pres; H E Brown and G S Thomson, vice-pres . . . **The Baldwin Locomotive Works** names **Frank K Metzger** vice-pres in charge of sales . . . **Georgia Power Co** selects three new vice-pres: W H Wright, secy; W P Hammond, chief engr; J M Oliver, operating mgr. H W Boozer is comptroller.

Pennsylvania Transformer Co announces that **W R Swoish** is sales manager. . . . **Thorp E Wright** has joined the copy staff of **Erwin, Wasey & Co.** . . . Jas V **Donohoe** has been promoted to asst sales mgr, **Mixing Equipment Co.** . . . **Raymond Ackerman** is sales representative, **Porcelain Products, Inc,** for Utah and parts of Nev. and Wyo. . . . **Metallizing Co of America** announces that **Henry D Engelsman** is sales mgr and technical service supervisor. . . . **Fisher Governor Co** has appointed **Johnson and Scott** sales representatives in the Memphis, Tenn.,

I-T-E DRAWOUT SWITCHGEAR

Features You Want in Unit Substations



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(2) **CONNECTING THROAT** — Close-coupled as shown, or built to pass through a wall, or clear an obstruction.

(3) **BREAKER BANK** — Completely metal-enclosed, with drawout circuit breakers . . . assuring safety for workers, protection for equipment and service continuity.

(4) **MAIN CIRCUIT BREAKER**—Backs up all the feeder breakers . . . cascading often saves material and reduces investment.

(5) **TIE CIRCUIT BREAKER** — Connects to another unit substation; transformer may be removed from service without interrupting power supply.

(6) **FEEDER CIRCUIT BREAKERS**—Drawout type . . . spare breaker may be substituted during periodic inspections.

(7) **BUS TRANSITION FRAME** — Provides for branching buses . . . instruments may be mounted on doors.

Advantages of Unit Substations have led to rapid adoption and will lead to much wider use—saving in cable copper, reducing voltage drop by employing short feeders, saving in space with compact arrangement of indoor transformers and breaker banks, quick installation and equally simple removal to a new location.

Design and construction of the unit are important in providing such advantages in fullest measure.

The features of design and construction identified on this page are but a few that I-T-E engineers will gladly go over with you.

Representatives in Principal Cities

I-T-E

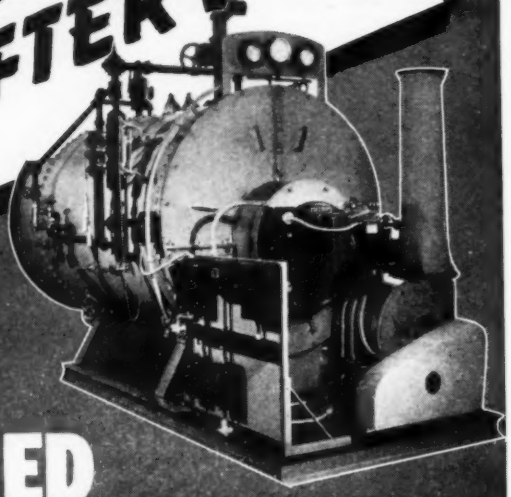
AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

I-T-E CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.

PRE-WAR BOILERS WON'T DO AFTER V-DAY



Modernize *Now* with a PREFERRED UNIT STEAM GENERATOR

- *Many steam producing plants in service today are 15 to 20 years behind the times.*
- *They are 20% to 25% under-efficient.*
- *Post-war economies will insist on highly efficient, fuel-saving equipment.*

Preferred Unit Steam Generators have an efficiency of 80%—as against 60% to 65% which was maximum in pre-war boilers *when originally designed* some 15 to 20 years ago. In the years of service since, those generators have dropped to still lower efficiencies.

The ultra-modern Preferred Unit Steam Generator brings you oil burner, boiler, controls, piping, wiring all closely coordinated into one single, compact, space-saving, portable, astonishingly efficient unit.

Everything necessary to start producing steam as soon as you set the unit down and hook it up. No stack required. No special foundation—unit comes mounted on its own H-beam steel base.

Developed to meet wartime needs, the Preferred Unit Steam Generator has proved itself under high production demands in varied activities. Available in sizes from 20 H.P. to 500 H.P. Send coupon for descriptive Bulletin 1000, and a copy of "Dividends from Your Power Plant" which sells nothing but ideas that are helping engineers who have an eye to the future.

PREFERRED UTILITIES MANUFACTURING CORPORATION
1860 Broadway, New York 23, N. Y.

Please send, without obligation the bulletins checked.

☐ UNIT STEAM GENERATOR
☐ DIVIDENDS FROM YOUR POWER PLANT

NAME_____

ADDRESS_____

Pr. 7-44 _____

for Results

PREFERRED UTILITIES

territory. . . . **Herr-Harris Co** has been appointed representative of **The Edward Valve & Mfg Co** in the Charleston and W. Va. territory.

Ray Austin, of Wyo-Mont Distributors, will represent **Dugas Engrg Corp** in Mont. and Wyo. . . . **Willis Engrg Co** has been appointed agents for **Kieley & Mueller, Inc,** covering most of Ohio. For Ga. their agents are **Garrard & Seat.** . . . **U. S. Rubber Co** names **Ernest G Brown** general mgr of mechanical goods, general products and Lastex yarn and rubber thread div. . . . **The Philip Carey Mfg Co** has appointed **C B Pooler** vice-pres. in charge of mfg.

Consolidated Industries, Inc, has entered the stoker field in Indianapolis, Ind. They will manufacture the *Winter Automatic Stoker,* for commercial, industrial and domestic applications. The management is experienced in the stoker industry. Its president, **W T Winter,** was vice-pres in charge of sales supervision of Winkler stokers. **R G Herbig,** secy-treas, was secy and financial mgr, U. S. Machine Corp. The new company has developed some revolutionary advancements in stoker design and performance. The engrg, designing and testing have been carried forward for many months. Full personnel of the board of directors will soon be announced.

W T Winter

Timken Roller Bearing Co has organized a subsidiary, The Timken Roller Bearing Co of South America. After the war, the new firm will handle engrg development of Timken products in Latin America. J A Morland, former N. Y. representative, is mgr of the subsidiary and is now in Sao Paulo, its headquarters.

As part of its program, Timken has two young Brazilian engineers, Murillo G Moreira, Rio de Janiero, and Jose M Chaves, Sao Paulo, in its Canto plant, where they are familiarizing themselves with engrg production and application of roller bearings and steel.

In describing the move, W B Moore, Timken general sales mgr, said that in the past the company worked through So. American distributors, whose primary function was to handle replacement-bearing trade and who will continue in this capacity.

Barber-Colman announces that **Wain Engrg Co** is its distributor for the Omaha, Neb., territory. . . . **Frank W Bemis** is

Prevent Explosions

WITH fireye PHOTOELECTRIC FLAME SAFEGUARD IN OIL, OR PULVERIZED COAL BURNERS

WHAT FIREYE DOES ... HOW IT DOES IT

The photoelectric cell of Fireye observes pilot, main flame or both through a small window in the wall of the fire chamber.

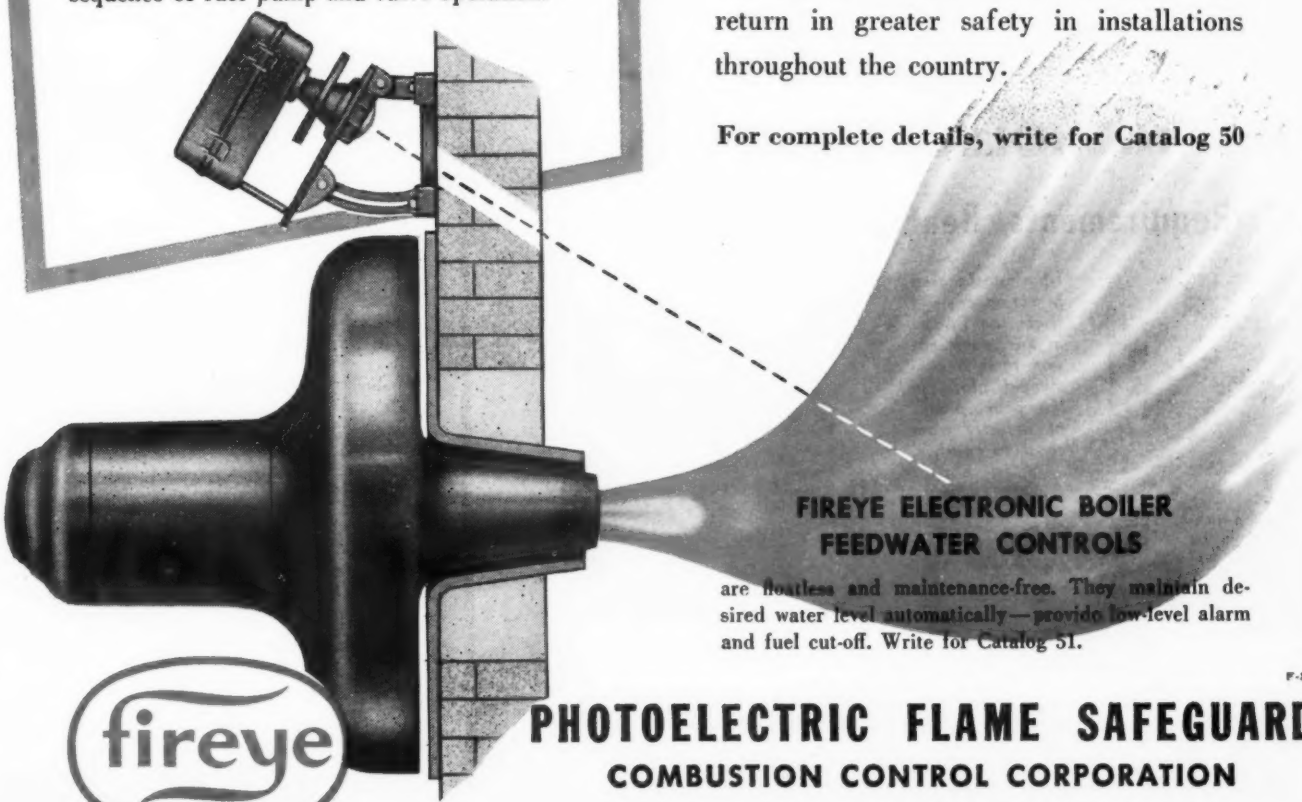
When the flame fails Fireye acts *instantly*, releasing a flow of electrons—a microcurrent that is amplified to control manually ignited burners by turning off both main and pilot fuel valves and sounding an alarm . . . or when burner is fired automatically, to provide desired sequence of fuel pump and valve operation.

The danger of explosion is ever present in pressure-fed heating equipment. Fireye Photoelectric Flame Safeguard acts to prevent this hazard—acts with the speed of light, the light of the flame itself.

Thus—there is no *danger interval* between flame failure and fuel shut-off . . . no time for the oil or pulverized coal to enter the combustion chamber and create a dangerous explosive mixture.

Fireye equipment is a self-contained unit of proved performance, easily installed—a moderate investment that is paying a high return in greater safety in installations throughout the country.

For complete details, write for Catalog 50



FIREYE ELECTRONIC BOILER FEEDWATER CONTROLS

are floatless and maintenance-free. They maintain desired water level automatically—provide low-level alarm and fuel cut-off. Write for Catalog 51.

F-2

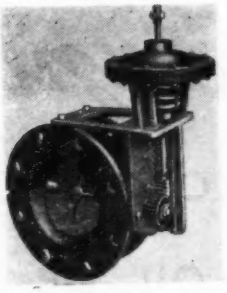
fireye

PHOTOELECTRIC FLAME SAFEGUARD

COMBUSTION CONTROL CORPORATION

Cambridge 42, Mass. • District Offices in all Principal Cities

Valve Operation *Centralized* In One Automatic Control Mechanism



Standard flanged butterfly valve with air diaphragm motor actuating valve stem.

In addition to the full line of manually controlled units, Rockwell Butterfly Valves for Air, Gas or Liquids are fitted with electric motor, air diaphragm, hydraulic or any other mechanical control for automatic regulation of flow and quick shut-off of single valves or in interlocking multiple valve batteries from one control mechanism. This eliminates dependence on the human factor. Declutching units can be applied for emergency manual control.

Rockwell Butterfly Valves are standard in any metal in 1" to 48" pipe sizes—hooked up as your plant or process requires.

Battery of 4 threaded butterfly valves linked for automatic control from one electric motor

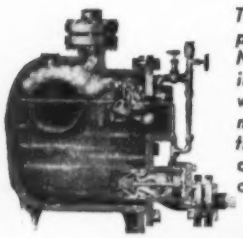
Write for Catalog No. 406

W. S. ROCKWELL COMPANY
48 Church St. New York 7, N. Y.

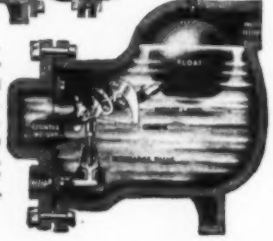
ROCKWELL VALVES
SLIDE and BUTTERFLY
FOR AIR • GAS • STEAM • LIQUIDS • SOLIDS

These are Trying Times for Traps

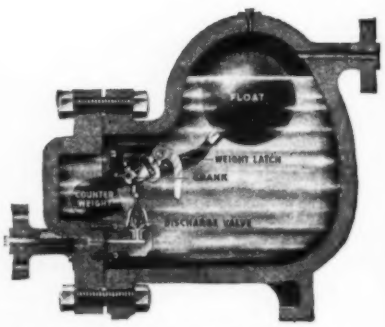
And Peak Production is Proving AGAIN That NICHOLSON TRAPS Meet All Requirements, Beat Many Specifications



The outstanding performance of Nicholson Traps in war plants has won them a permanent place in the "peace plans" of industry from coast to coast.



There's a Nicholson trap for practically all purposes. Above, Piston-Operated Steam Trap. Right, Model "J R" Compressed Air Trap.



WEIGHT-OPERATED STEAM TRAPS

A large-capacity trap for pressures to 1500 lbs. at 1000 degrees maximum temperature. Positive automatic intermittent action. Quick opening and closing valve. Water-sealed discharge.

Trap Catalog 941
Also See Sweet's

W. H. NICHOLSON & CO.
125 Oregon St., Wilkes-Barre, Pa.

sales mgr, American cable and hazard wire rope div, **American Chain & Cable Co, Inc.** . . . **Goodyear Tire & Rubber Co** has placed **R D Vickers** in charge of plastics and chemical sales in the East. . . . **Lincoln Electric Co** has made **G L Revell** district mgr of the Portland, Ore., office.

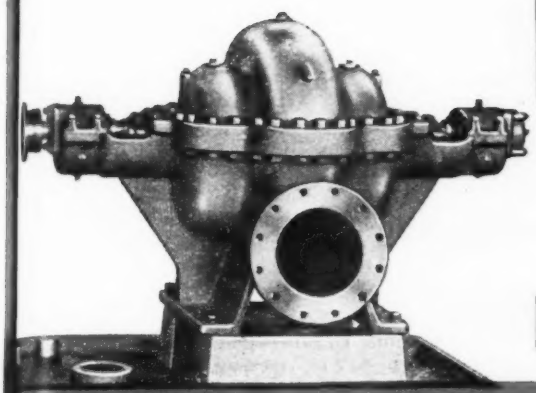
Major Maurice B Bradley has returned from active service in the U. S. Army to **Robins Conveyors, Inc,** where he will devote his attention primarily to the sale of vibrating machinery—screens and shakeouts. . . . **Wallace Johnson** is named general sales mgr, **Joshua Hendy Iron Works,** Sunnyvale, Calif. . . . **Ross Heater & Mfg Co, Inc,** has appointed **Arleigh W Anderson** sales representative, So Calif. territory. . . . **Brown Instrument Co** names **Ed Crane** industrial sales engr in the Buffalo area.

Westinghouse announces the retirement of **Wm P Cockhran,** central station div mgr, and **Franklin P Bell,** Middle Atlantic district treas-mgr. The Trafford, Pa., works div announces the appointment of **C P Croco** as mgr of a newly formed welding dept.
Other Westinghouse appointments are: **John M McKibbin,** asst to B W Clark, vice-pres. Added to his duties is responsibility for all product and industry advertising. . . . **R C Brannan** is now mgr, transformer equipments section, transformer div, Sharon, Pa. . . . **J B MacNeill** is mgr, switchgear and control div. . . . **T C Monk** is asst to lamp div mgr. . . . **Wm C Robinson,** pres, National Elec Products Corp, is elected a Westinghouse director. . . . **R A McCarty,** vice-pres in charge of subcontracting activities, on leave, will assume an executive position with Smaller War Plants Corp, Washington.

General Elec Co has elected **John G Farrar** comptroller of the company. **A F Dickerson,** mgr, lighting div, was made a doctor of engrg by Texas A & M College. **Other GE announcements** are: **Owen D Young** and **Gerard Swope** were for the 21st time elected board chairman and president respectively. . . . **H V Erben,** mgr, central station divisions, has been elected a commercial vice-pres. . . . **Willard V Merrihue** is mgr of adv and sales promotion div, apparatus dept.

Rob Roy MacLeod, executive vice-pres, Niagara Falls Power Co, was elected executive vice-pres, **Buffalo Niagara & Eastern Power Corp.** . . . **Basil J Wilkinson,** administrative asst to the district mgr is district mgr, Cattaraugus div, **Niagara, Lockport & Ontario Power Co.** . . . **National Supply Co** has elected **Albert T Huizinga** vice-pres and treas. . . . **Bernard F Stolinsky** was elected Board chairman, **Pipe & Tube Products, Inc.** . . . **Thos Gallagher,** asst treas and mgr of **Handy & Harman of Canada, Ltd,** was elected a director.

Union Carbide and Carbon Corp elected the following presidents of subsidiary companies: **Joseph G Davidson,** Carbide and Carbon Chemicals Corp, and Carbide and



IMBRICATION

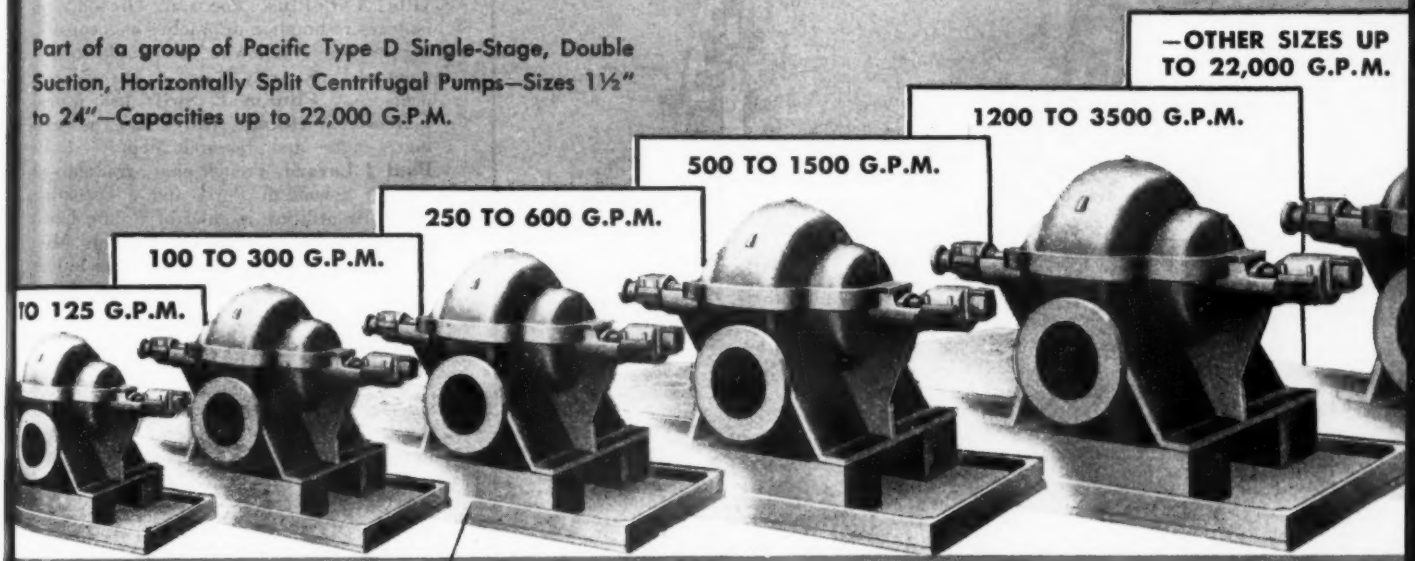
Overlapping

POWER AND PERFORMANCE

ACIFIC "IMBRICATION" CHART

Indicating the long range flexibility in PACIFIC *Engineered* Centrifugal Pumps

Part of a group of Pacific Type D Single-Stage, Double Suction, Horizontally Split Centrifugal Pumps—Sizes 1½" to 24"—Capacities up to 22,000 G.P.M.



vides *maximum* efficiency, economy and safety in meeting *every* pumping requirement

Available in an unsurpassed range of types and sizes, Pacific *Engineered* Centrifugal Pumps have been developed and imbricated to insure, in each individual size, the highest pumping efficiency, the widest operating economy and the greatest margin of safety possible. Precision engineered design and construction, with many exclusive features, provide incredible toughness and endurance, even under the most severe conditions.

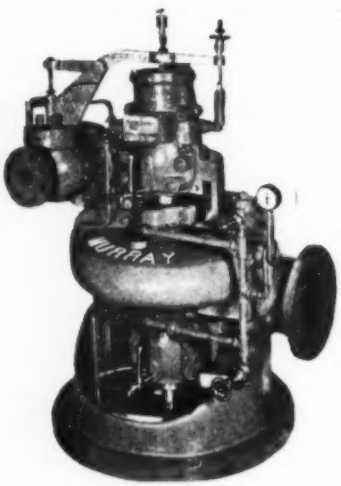
Pacific's complete and diversified line embraces centrifugal pumps for all utility purposes—municipal, industrial, power house and high pressure boiler feed water service. Pumps that defy temperature, chemicals, acids, corrosion.

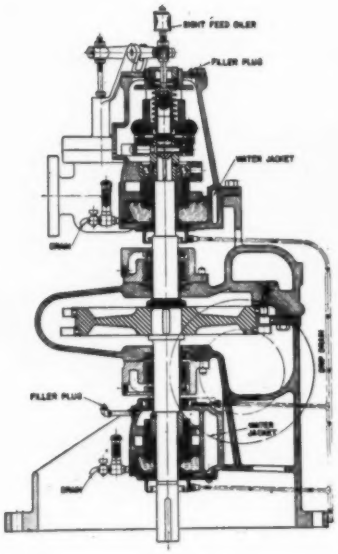
New and expanding production, new processes make new and varied demands on flow equipment. Old equipment seldom fills the bill. Contact Pacific to be sure! Pacific engineers and Pacific equipment ably answer *all* pumping problems. Performance records the world over prove that!

PACIFIC PUMP WORKS, Huntington Park, California
One of the Dresser Industries* • MID-CONTINENT PUMP SUPPLY CO., Tulsa, Okla. *A Division of Pacific Pump Works

PACIFIC *Engineered* PUMPS

MURRAY
VERTICAL
STEAM TURBINES





To drive vertical shaft pumps MURRAY can furnish either direct-connected or geared turbines for steam conditions up to 600 pounds initial pressure, 750 degrees F. total temperature and 50 pounds back pressure, and for ratings up to 200 HP.

Following the same quality construction furnished on horizontal turbines, standard equipment includes mechanical constant speed governor on the main shaft, bolt type emergency overspeed governor, carbon ring glands, babbitt lined sleeve type bearings pressure lubricated, and ball type thrust bearing arranged to carry up and down thrust.

MURRAY also builds:

Single and multistage horizontal turbines
Turbine Generator Sets up to 2500 KW
Reduction gears
Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

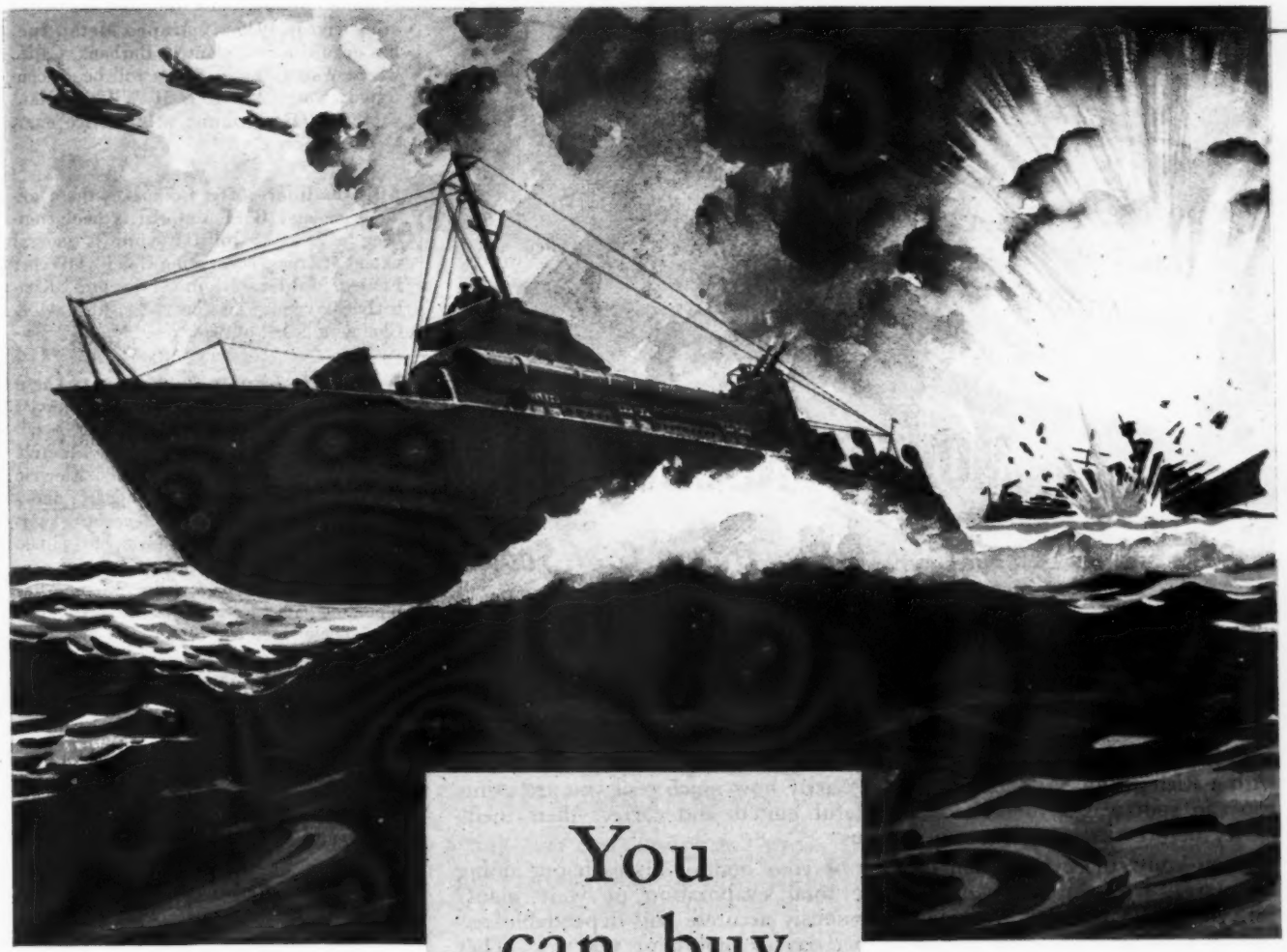
Carbon Chemicals, Ltd; **Jas W McLaughlin,** Bakelite Corp; **Stanley B Kirk,** The Linde Air Products Co, The Prest-O-Lite Co, Inc, Dominion Oxygen Co, Ltd, and Prest-O-Lite Co of Canada, Ltd.; **Arthur V Wilker,** National Carbon Co, Inc, and Canadian National Carbon Co, Ltd; **Francis P Gormely,** Electro Metallurgical Co, Electro Metallurgical Co of Canada, Ltd, Haynes Stellite Co, Michigan Northern Power Co, Union Carbide Co of Canada, Ltd; **John D Swain,** Electro Metallurgical Sales Corp; **John R Van Fleet,** U. S. Vanadium Corp.

Greater N. Y. Safety Council reelects **Frank L Jones** pres for a 5th term and recommends expanded activities to combat home, school, job accidents. . . . **L C Welch,** asst genl mgr of sales in charge of lubricating and sales technical service depts, **Standard Oil Co of Ind.,** is elected to the Board of Directors . . . **Glenville A Collins,** Portland, Oregon, announces resumption of practice as a consulting engineer, following honorable retirement as U. S. Army Major, Corps of Engineers. . . . **Clinton E Swift** has joined **Eutectic Welding Alloys Co** as asst mgr, engrg and research dept. . . . **Lt Paul J Lazard,** French engr, graduate of Mining School of Paris and a specialist in public utilities, is chief of Public Utilities section, **Metropolitan French Mission.** . . . **Jos M Smith** is technical director, **Fluorescent Lighting Assn.**

Wm F Lamoreaux is research metallurgist, **The Cooper-Bessemer Corp.** . . . **Harry M Iverson** is comptroller of **Carrier Corp; F F Hoyt,** vice-pres, who formerly served as comptroller is chief financial officer. . . . **Monsanto Chemical Co** names **E A O'Neal** production mgr, phosphate div; **Jas A Wilson** succeeds him as Trenton plant mgr. . . . **Edw N Haas** is works mgr, Aurora, Ill., plant, **Independent Pneumatic Tool Co,** succeeding W H Brewer, general factory mgr. . . . **R Paul Smith,** pres, Northern Va. Power Co is elected pres, **Southeastern Electric Exchange.** . . . **A V Sproles** is named general supt, **Pocahontas Fuel Co.** . . . **Louis D Ponzio** is mgr, estimating dept, **Hydrocarbon Research, Inc.**

American Screw Products announces that its new name is **The Deutsch Co** . . . **National Research Bureau, Inc,** changes their address to 415 N Dearborn St, Chicago 10, Ill. . . . **Allen-Bradley Co** has moved their offices in Cleveland, O., to 4506 Prospect Road. . . . **Cutler Hammer Inc** has moved their Portland, Ore., sales office to 131 SW 4th Ave. . . . **The Bristol Co** has opened a branch in the Citizens State Bank Bldg, Houston, Tex.

Commonwealth Edison has elected **Alex D Bailey** and **Curtis A Lambert** to succeed respectively H B Gear, vice-pres, in charge of operating and engrg, and A G deClercq, vice-pres in charge of service and construction. Entering the company in 1903 as draftsman, Mr Bailey became chief engr, Fisk and Quarry generating stations, supt of generating stations and asst chief operating engr. He was named chief oper-



You can buy Engines proved in Hell

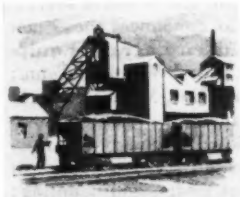
NEW POWER FOR A NEW WORLD

Sterling engines are now being tested for their post-war assignments on the toughest proving grounds of all times—the fighting fronts of the world. They are powering the battle craft of the Allied navies and armies.

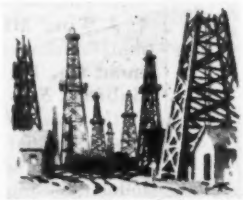
The war has taught us to build Sterling engines that better meet the needs of a wide range of applications in the industrial as well as the marine fields. Now these engines give greater horsepower per pound of weight and give more economical operation than ever before. And still they are precision-built.

Write us and we shall be glad to put at your disposal immediately the technical ability of Sterling engineers and the invaluable experience of practical field men to help you replace immediately your overworked stationary and stand-by engines.

STERLING ENGINE COMPANY, Buffalo, N. Y.
Offices in New York, Washington, Chicago.



Coal for America comes from mines ventilated by fans operated by Sterling driven generator units.



"Black Gold" is lifted 15,000 feet or more from out of the ground with pumps powered by Sterling engines.

Mountain streams forced by Sterling driven pumps turn deserts into fertile and profitable productive farm lands.

When disaster strikes, Sterling engines are immediately on the job to supply stand-by power in any emergency.

For civilian purposes of a hundred sorts Sterling can provide engines greatly improved over former pre-war design.

STERLING ENGINES

GASOLINE DIESEL GAS

"KEEP BUYING WAR BONDS"

"Next winter's estimated 20-million ton coal shortage can be cancelled by consuming 5% less."—GEORGE EDWARDS, *Advisory Editor POWER, May 1944.*

MORE CONSERVATION—MORE POWER *with Richardson Coal Scales*

To stretch America's seriously limited coal supply . . . to help our nation meet the estimated needs of 620 million tons . . . Richardson urges you to aid the National Fuel Efficiency Council attain its first year's objective — the conservation of 29 million tons of coal.

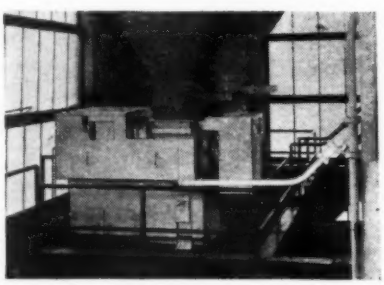
Richardson can help you do your part by getting the most out of the coal you now have — or the little that you may get, should the shortage call for some form of allocation this winter. By weighing every ounce of coal with a Richardson Scale and knowing exactly how much coal you are using, you can spot waste, identify the wasteful boilers and correct their inefficiency before fuel losses become serious.

Do you know the evaporation of each of your boilers? Is each one doing its best? Do you know exactly the total evaporation of your plant? Richardson Coal Scales give you continuously accurate and dependable records per boiler, per hour, per shift, per day or month or year . . . They provide a positive check on coal used in relation to power produced.

Weigh your coal from bunker to stoker hopper or pulverizer with Richardson Automatic Coal Scales—used by hundreds of industrials, public utilities and municipalities.

Bulletin 1143 gives technical data, photographs and diagrams of standard and elongated models. Write today for your copy.

Typical Richardson Streamlined Dustproof Automatic Apron Feed Conveyor Type Coal Scale.



Two of Eight Richardson Coal Scales Weighing from Hoppers to Pulverizers in a Large Public Utility Power Plant.

Cooperate with the NATIONAL FUEL EFFICIENCY COUNCIL in its Coal-Saving Goal of 29 Million Tons!

6073

RICHARDSON SCALE CO.

CLIFTON, N. J.

Atlanta • Boston • Chicago • Omaha • Montreal • New York • Philadelphia Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh

ating engr in 1936 . . . **Ampco Metal, Inc,** has opened a new plant in Burbank, Calif., where West Coast activities will be concentrated; works mgr is **E H Wilson,** plant supt, **P P Bergmann;** field service engr, **O D Cooper.**

Allis-Chalmers Mfg Co makes these announcements: **B H McCoin** is field engineer in Atlanta; **John J Kane** is general patent attorney, succeeding Geo F DeWein; **Ernest Mahler,** executive vice-pres, Kimberly-Clark Corp, has been elected to Allis-Chalmers board of directors.

Worthington Pump & Machinery Corp has appointed **Thos J Kehane** commercial vice-pres, in charge of Pacific Coast activities. The company has purchased **Electric Machinery Mfg Co,** Minneapolis. Electric Machinery will continue to operate independently, with its present executive personnel. . . . **Carroll E Lewis** has joined **Perfex Corp** as vice-pres and mgr of controls div. . . . **Thos A Edison, Inc,** has appointed two vice-pres: **K G Berggren,** mgr, special products div; **C D Geer,** general mgr, instrument div. . . . **Robt L Coe,** vice-pres, Chase Brass & Copper Co, Inc, was reelected pres, **Copper & Brass Research Assn** at its 24th annual meeting.

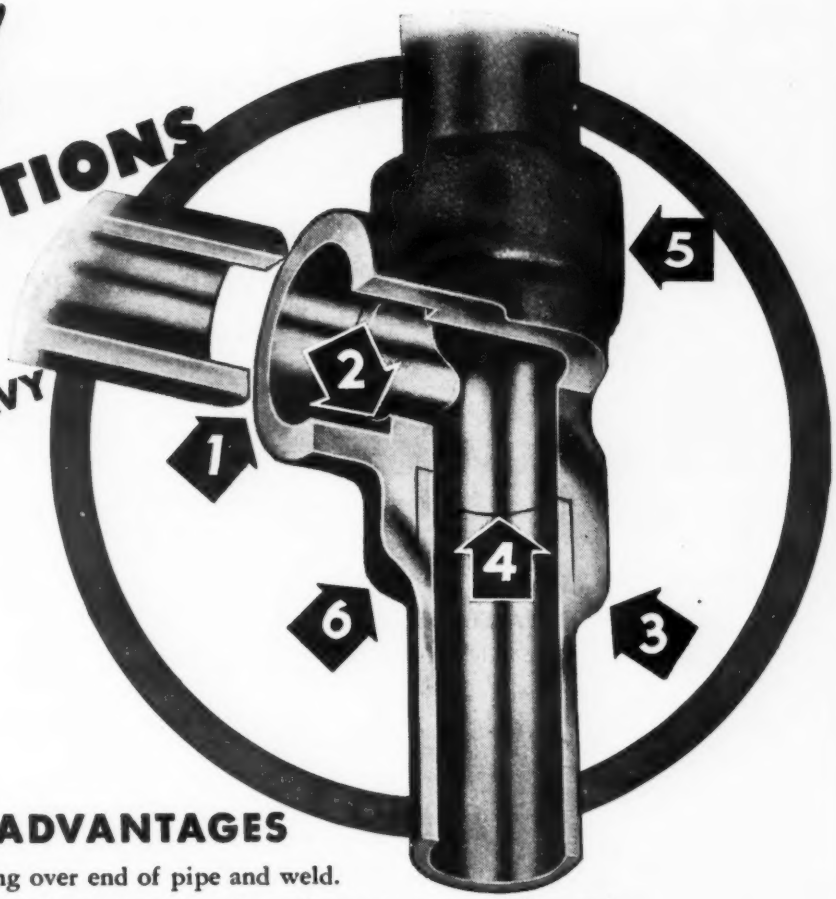
American Institute of Electrical Engineers elects as officers: *Pres,* Chas A Powel, mgr, headquarters engrg dept, Westinghouse Elec & Mfg; *Vice-pres* R T Henry, J F Fairman, M S Coover, R W Warner, C B Carpenter; *Directors,* P L Alger, M J McHenry, D A Quarles, *Natl Treas,* W I Slichter (reelected).

Thos E McKee, engr, Dunlop Tire & Rubber Co, has been elected pres, **Keystone Assn** 16, Natl Assn of Power Engineers; **Alon Carter** is vice-pres; **Henry G Lamy,** treas; **Wm L Buchs,** financial secy; **Frank W Savage,** recording secy; **L W Thiele,** corresponding secy . . . **Harold C Hamilton,** Boston Edison Co, is pres, Engineering Societies of New England, 1944-5; **Albert Haerlin** and **Prof Jas Holt** are vice-pres; **Wm White** is secy and **C A Farrell,** treas.

Cornell-Dubilier Electric Corp has appointed **Dan Fairbanks** sales mgr of the jobbing div . . . **A H Kruger** has joined **Wheelco Instruments Co** as application engineer . . . **Fisher Governor Co** has appointed **The Sullivan-Mears Co** its representative in Kan. and Western Mo. . . . **L J Wing Mfg Co** announces these new representatives: **Glidden Engrg & Equipment Co,** Tex; **E Lloyd Widner,** Tenn.; **Babcock & Wilcox, Ltd,** Mexico; **Sergio Ortiz Toro,** Venezuela . . . **Detrex Corp** announces that **Thos J Kearney** has been promoted to asst chief engr, in charge of industrial equipment design and detailing; **John A Faler** will take charge of extraction equipment development.

A S Shoffstall retires as genl mgr, **International Nickel's** Huntington Works, continues as consultant to head office; **Herman M Brown** succeeds him as genl mgr; **John A Marsh** is asst genl mgr . . . **Philco Corp** names **John M Otter** sales mgr, home

Speed PIPE CONNECTIONS ON STANDARD EXTRA HEAVY AND DOUBLE EXTRA HEAVY PIPE LINES



TIME-SAVING ADVANTAGES

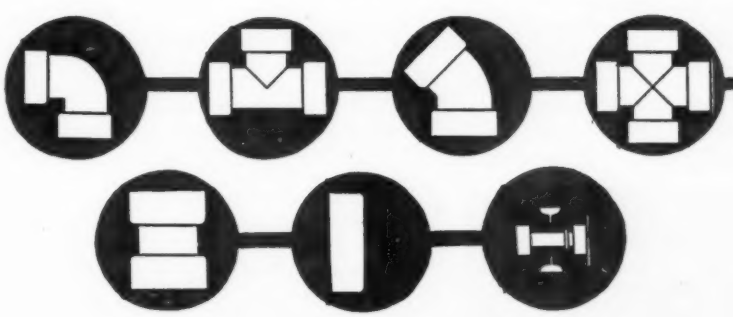
- ***Easy To Install***—slip fitting over end of pipe and weld.
- ***Deep Socket***—supporting and aligning the pipe, eliminates tack welding and the use of special fixtures. Accurate measuring and cutting of pipe unnecessary —Ample come—and—go.

MAINTENANCE-SAVING ADVANTAGES

- ***Position of Weld***—prevents welding icicles inside pipe—no clogged lines. Wall sections 1¼ times the nominal pipe thickness permits proper heat penetration and correctly proportioned fillet weld.
- ***Smooth Flow***—assured as inside diameter of fitting matches inside diameter of pipe.
- ***Long Bands***—extending well beyond bottom of socket, provide ample reinforcement, eliminating weak sections.
- ***Strong, Trouble-free Joints***—the fitting and pipe are fused into one integral unit permanently tight and leak-proof. Unaffected by vibration, distortion and shock.

W-S Forged Steel Socket Welding Fittings are machined from solid drop forgings. Available for use with Standard Pipe—Schedule 40 Extra Heavy Pipe—Schedule 80 and Schedule 160 Pipe, and Double Extra Heavy Pipe. Sizes ¼" to 4" I.P.S. Each class can be furnished in Carbon Steel; Carbon-Molybdenum Steel; Chromium-Molybdenum, Steel or Stainless Steel. Conform to ASA Standards. Ask for Bulletin A-3.

Sold Through Leading Distributors



The WATSON-STILLMAN Co.
ROSELLE, NEW JERSEY

Pictured above is a Sauerman Scraper System serving a large generating station where scraper stores and reclaims upwards of 200,000 tons of coal a year. Note the self-propelled tail tower which is remotely controlled from the operator's station. Sitting in his comfortable cab above the receiving hopper, the operator has finger-tip control of every move of the scraper.

Costs Less

TO: { BUY, USE, MAINTAIN

SAUERMAN POWER SCRAPER

LOW original cost and low maintenance cost mark this permanent trouble-free investment in better handling of both large and small stockpiles of coal.

Sauerman economies start by saving labor. ONE man operates the Sauerman scraper from a control station. More efficient reclaiming and storing of coal in smaller space is another cost saver . . . and the elimination of spontaneous combustion through proper piling without segregation is an important SAFETY feature.

SAUERMAN ADVANTAGES

- Low-cost equipment
- One-man operation
- Makes a homogeneous pile, safe from any danger of heating
- Simple upkeep
- Adjustable range
- More tons stored on every square foot of space

WRITE FOR CATALOG

SAUERMAN BROS., Inc.

562 S. CLINTON ST., CHICAGO 7, ILL.

TROUBLE FREE SERVICE

...Year in, Year out

That's what you can expect, and will receive if you specify Economy's "Sure-Flow" Vertical Non-Clog Pump. Especially designed to pass solids, rags, sewage and trash *without vibration* or whip from shock of temporary unbalance by heavy objects entering the impeller. Motor is mounted in a yoke directly above the pump and *flexibly coupled* to the pump. The pump has its own heavy duty bearings and separate shaft. Economy Non-Clog Pumps are ideal for:

- Sewage Disposal
- Underpass Drainage
- Food Industries
- Chemical Industries
- Paper Mills
- Sludge Removal
- Overflow Service
- Reduction Plants

If your problems fall in any of these applications—write today for Bulletin F534. It tells a story well worth reading.

Economy's Vertical Non-Clog Pump. Cap. 100 to 20,000 G.P.M. Heads to 200 ft.

ECONOMY PUMPS, Inc.

HAMILTON, OHIO, U.S.A.

radio div; **Walter H Eichelberger** sales mgr, refrigerator div . . . **The Babcock & Wilcox Tube Co** announces that **Marcel A Cordovi** joins them as research metallurgist; **John C Traphagen** has been elected to the Board of Directors of The Babcock & Wilcox Co . . . New officers of the **Dampney Co** are: **Clarence J Hunter,** pres & genl mgr; **J W Laverack,** vice-pres & treas; **J Dwight Bird,** vice-pres, in charge of railroad and midwest power sales; **Wm Richards,** vice-pres in charge of marine sales.

The Marley Co, Inc, has made **Ray T Jenkins** and **Jos A Cameron** vice-pres. Mr Jenkins, now genl sales mgr in Kansas City, is succeeded as director of the Houston div by **Joe T McKinley.** Mr Cameron continues in charge of eastern seaboard div . . . **Wm L Rodgers** has joined **Goodyear Tire & Rubber Co's** mechanical goods dept to handle V-belt sales, the Chicago ty . . . **Boston Woven Hose & Rubber Co** has made **John H Rowe** vice-pres in charge of western sales—from Chicago to the Pacific Coast; **Stuart A Guild** becomes mgr of the Chicago office . . . **Harry W Gray** has joined **Manning, Maxwell & Moore, Inc,** as instrument sales engineer.

Wickwire Spencer Steel Co names **R T Dunlap** vice-pres in charge of production; **A G Bussmann** is advanced to be asst to the pres; **B L McCarthy** becomes asst genl supt of the Buffalo plant; **C A Gordon** is supt, hot depts, Buffalo . . . **Chester E Haring,** former director of marketing, **Batten, Barton, Durstine & Osborn,** is in active charge of the postwar marketing research project. **Committee for Economic Development;** asst director is **J L Barrett** . . . **Caterpillar Tractor Co** has named **Wm Blackie** and **Wm J McBrian** vice-pres; **Wm H Franklin** has been made controller, and **Edw W Jackson** is genl parts mgr. **M J Gregory** has retired as factory mgr of the foundry div, Peoria, Ill.

The Carborundum Co announces three new sales offices: Buffalo, N. Y., **G S Rogers** in charge; St. Louis, Mo., **Gordon O Watson;** San Francisco, Calif., **W T McCargo** . . . **General American Transportation Corp** announces formation of General American Process Equipment as a div, and the opening of the New York City office. **Conkey Filter Co** and its former officials will be associated with the div . . . **Cutler-Hammer** has opened a new drive-in warehouse at 1200 Walnut St, Cincinnati, O. . . . **The Meehanite Metal Corp** announces two new India companies in production of Meehanite castings: **Jessops & Co,** Ltd, Calcutta; **Binny & Co,** Ltd, Madras.

McCulloch Engrg Corp announces a change in the organization's name to **B-W Superchargers Inc;** no change in affiliation with parent co, Borg-Warner . . . **Alpha Metals, Inc,** is the new corporate title of Alpha Metal & Rolling Mills, Inc . . . **Penn Electric Switch Co** appoints **The Buchen Co** as its adv agency . . . **V H Hiermeier** is named industrial mgr, St. Louis office, **Brown Instrument Co** . . . **Warren K Lee** is appointed factory mgr, **Wilkening Mfg Co's** Philadelphia headquarters.

Planning the designs for tomorrow's

KEROTEST

Dependable Valves

With the "KNOW-HOW" Gained Through Years of Experience On Diversified INDUSTRIAL APPLICATIONS

You should have a copy of this informative Kerotest catalog in your files for present and post war references.

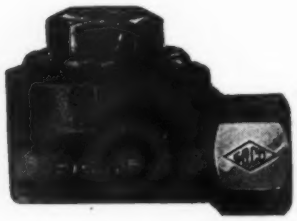
We at KEROTEST know well the desperate pressure and rush of war production—we're serving tirelessly to meet America's needs for dependable precision built valves. But NEVER in this emergency has KEROTEST'S quality standard been sacrificed for speed. Greatly increased facilities?—Yes. Add and train thousands more men?—Yes. Engineering and research staff on a "round-the-clock" offensive?—Yes. But lower the standard of KEROTEST dependability and precision?—NEVER.

With peace, the rigid adherence to this sound policy will again mean much in the adaption of KEROTEST Dependable Valves to your industrial valve control requirements.

KEROTEST MANUFACTURING COMPANY
PITTSBURGH, PENNSYLVANIA

EDCO

SPRAY NOZZLES



for RE-COOLING AND AIR-CONDITIONING

Any industrial atomizing —cooling—or washing operations that call for spray nozzles can be done *better* with Edco.

Here's why: every EDCO tip is carefully designed and checked for spray angle, atomization and actual rated capacity — goes through rigid inspection before the EDCO diamond is stamped on it.

EDCO *is furnished in*

STAINLESS STEEL
BRONZE
NITRALLOY
MONEL
STONEWARE
HARD RUBBER

For savings offered by EDCO write at once for Booklet 3C1.

EDDINGTON METAL SPECIALTY CO.

P. O. Box K Eddington, Pa.

CURRENT AWARDS

Army-Navy E pennants now fly over: Saltville plant, The Mathieson Alkali Works, June 19; Stark Mills plant, U. S. Rubber Co, June 20.

White stars (Army-Navy E renewals) to: Plant Rubber & Asbestos Works, 1 star, June 14; Infilco, Inc, 1 star, May 27; Manhattan Rubber Mfg Div of Raybestos-Manhattan, Inc, 1 star; Caterpillar Tractor Co, 1 star, May 27; Kewanee Boiler Corp, 2 stars, May 27; Skilsaw, Inc, 2 stars, June 10; Habirshaw Div, Phelps Dodge Copper Products Corp, 3 stars; The Falk Corp, 4 stars.

Maritime Commission "M" pennant of Erie works, General Electric Co, has been awarded a second gold star. It is their 9th wartime production award.

Natl Safety Council "S" award has been presented to Caterpillar Tractor Co.

Natl Security Award, U. S. Office of Civilian Defense, was awarded to Commonwealth Edison Co, June 28.

Cornell University's $150,000 high-voltage laboratory is designed for research on transmission lines, transformers, and machines of a power system when subjected to high-voltage surges due to lightning, etc. Two types of **test equipment** are 60-cycle and impulse (lightning) voltages. The 60-cycle equipment consists of a bank of three transformers (combined output 750,000 v, single phase; 443,000 v, 3-phase) and power is supplied to the transformers by motor-generator sets rated to supply 650 kva. This gives sufficient test voltage for most transmission systems but if need arises for a test voltage of one million volts, space is provided for a fourth transformer.

Land Steam Turbine and Turbine Generator Industry Committee recommended cancellation of Schedule VI of L-154, limiting sheet-metal lagging and other accessories in manufacturing steam turbines. They believe justifiable exceptions are at a point where rescinding the order improves efficiency. Production schedules fill capacity and orders extend into 1945, while labor remains tight. Uncertainty of marine and foreign requirements make it difficult to predict the industry's actual load. However, while WPB wants to release work for the remainder of 1945 schedules, it is not yet possible to authorize turbines and generators that do not contribute directly to war.

Directory of the American Council of Commercial Laboratories has been published to inform business and governmental executives of the advantages of using independent laboratories in scientific, engineering, testing and inspection problems. For a copy of this 32-page booklet write the Executive Secretary, A J Nydick, 63 Wall St, New York 5, N. Y.

Sewell H Downs, nationally recognized authority in air conditioning and air handling, and chief engineer, Clarage Fan Co., was elected pres, Am Society of Heating and Ventilating Engr.

SERIVRON Protects Boiler and Tank Interiors Against **RUST and FUNGI**

Odorless Tasteless

Serviron is an ordorless, tasteless, permanently viscous material. It protects metal against corrosion, and prevents deterioration and fungus growths on wood, concrete or metal, submerged in water, brines and certain acids and caustics. Serviron issued extensively in boilers, laundries and refrigeration plants. It is unaffected by feed water treatment, and is used with equal success in hard and soft water. Serviron is ideal for drinking water tanks.

Easy to Apply—Serviron may be applied to any clean, dry surface with a stiff brush, and spread until a very thin coat remains. The applicator can work comfortably in cramped quarters because no obnoxious odors or gases are emitted.

Sticks Tightly—Unlike paint, Serviron does not dry. It bonds so firmly that it cannot be loosened.

Use Indoors or Outdoors—Serviron may be used in hot or cold water tanks, indoors or outdoors. Since it remains viscous within a wide temperature range, it expands and contracts with the surface, eliminating the danger of hairline cracks.

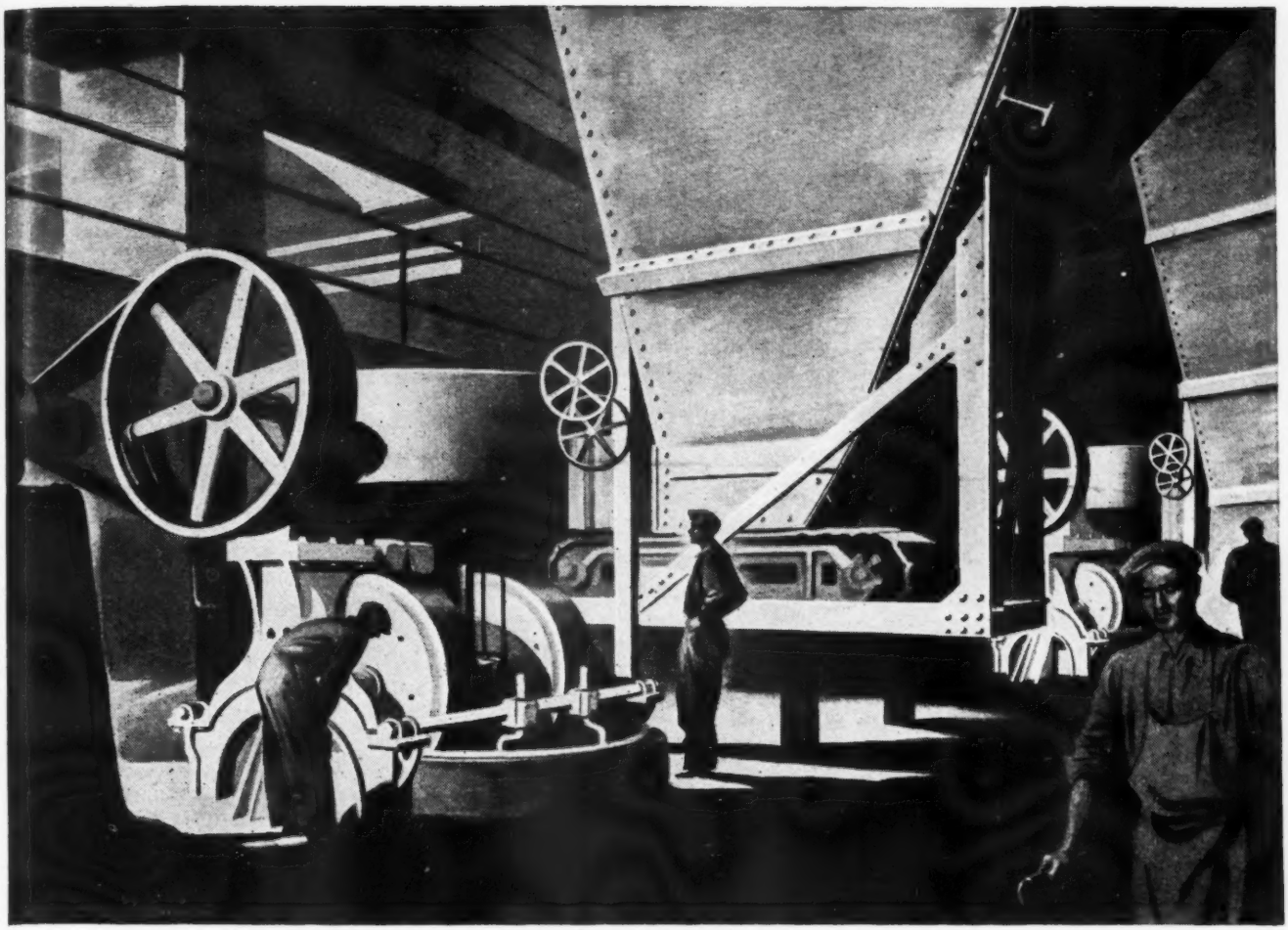
Economical—One gallon of Serviron goes a long way. A single, thin coat does the entire job. No primer is required. Its long-lasting protective qualities reduce maintenance, and assure clean, tasteless, rust-free water. Order a trial quantity.

Saverite Engineering Co.

Factories at

1029 Clinton Street, Hoboken, N. J.

5800 So. Hoover St., Los Angeles 44, Cal.



In ceramic production Stainless Steels, Nickel, Monel, and Nickel Alloyed Castings are used in many special applications.

NICKEL AIDS THE CERAMIC INDUSTRY

to KEEP 'EM PRODUCING!

Many Ceramic engineers and plant operators have found it necessary skillfully to integrate the best in methods and machines to achieve wartime production.

They made the refractories branch of the industry a War Giant that's striding forward with massive output for keeping metal going on its way to war. In critical war production areas building brick for plant expansions and cement for roads on which millions travel to their wartime tasks have been available in ample quantity and on time.

No essential industry has lacked supplies of ceramics.

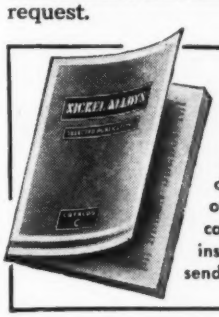
An important aspect in this achievement is the utilization of Nickel Cast Irons, Stainless Steels, Monel and other alloys containing Nickel... to combat the ravages of heat, corrosion and abrasion.

To minimize attendant interruptions of production, ceramic engineers... relying on their long peacetime experience with metals and alloys... made the judicious choice of Nickel alloys.

Their experience had shown them that a little Nickel goes a long way to keep equipment producing.

Nickel imparts hardness, toughness, strength and wear resistance. It fortifies crusher, rolls, scrapers and other critical parts of production equipment. Nickel is specified widely in processing mechanisms... such as muller tires, scraper blades, pug mill knives, chute liners and all manner of parts subject to severe abrasive action. Nickel alloyed parts provide long service life... reducing the need for frequent replacement. Thus it is practical for plant operators to increase output and general efficiency... and all this at a very reasonable cost.

For many years it has been our privilege to cooperate with foundrymen and engineers who desired help in the selection, fabrication and heat treatment of alloys. If you'd like to have such assistance... whatever your industry may be... counsel and data are available on request.

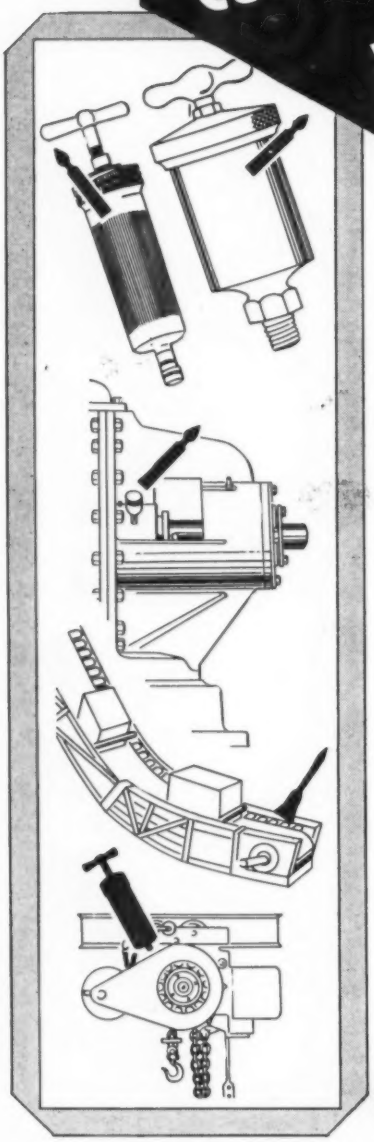


Catalog "C" makes it easy for you to get booklets and bulletins on industrial applications of Nickel, metallurgical data and working instructions. Why not send for your copy today?

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Protect Wearing Parts with DIXON'S CUP GRAPHITED GREASE



You give positive and economical protection to wearing parts of machinery when you use

DIXON'S CUP and PRESSURE GUN GRAPHITED GREASE

Dixon's prevents overheating, wear, and cutting under working conditions too severe for many greases. Extreme variations of temperatures, moisture, pressure, and speed do not affect its stable consistency. Its flake graphite delivers a full share of dependable and long lasting lubrication.

Lighter bodied than many greases, Dixon's flows quickly into bearings, keeping them cool. With it, friction-wear is reduced, bearings acquire a sleek protective graphite polish, and there's no "waiting" period for "heating-up". Users experience freedom from friction with this unusual lubricant.

A few of the many applications of DIXON'S CUP and PRESSURE GUN GRAPHITED GREASE.

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

Canada: Canadian Asbestos Company • Montreal • Toronto • Vancouver • Winnipeg

Ticonderoga, No. 635 and Microfyne Graphite • Pipe Joint Compound • Graphite Seal

Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease

SlipStik • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite).

A S M E Meeting

(*Continued from page* 89)

Segregation in Power Plants," Arthur J Stock, Stock Engineering Co, showed how the uneven distribution of the various coal sizes across the width of a stoker causes uneven burning with resultant loss in efficiency. With special cutaway sketches he followed the coal stream through conveyors, bunkers, silos, chutes and spreaders to the stoker, showing how segregation could be minimized at each step.

Mixing Bituminous, Anthracite

As a wartime measure to conserve bituminous coal by using one million tons more of fine anthracite (No. 3 buckwheat and smaller) Bureau of Mines is investigating mixtures of such coal in moderate quantities with bituminous slack for stoker firing. The paper by J F Barkley and William Seymour of the Bureau indicated the practicability of such mixtures.

Other research papers touching the power field include: "Factors Affecting the Thickness of Slag on Furnace Wall Tubes," by W T Reid and P Cohen, Bureau of Mines; "Heating-up Time and Energy Losses of Furnaces," by Victor Paschkis (Columbia University); "Economic Thickness of Thermal Insulation for Intermittent Operation," by C B Bradley and C E Ernst (both of Johns Manville) and Victor Paschkis.

Sikorsky at Dinner

Robert M Gates, president of ASME, presided at the well-attended convention dinner. Igor I. Skorsky, noted inventor, discussed the development and future of the helicopter. He predicted that hundreds of thousands of these machines would be in use ten years after the war.

Pacific Gas and Elec Co estimates that by switching heavily to natural gas in its 1944 power development it will turn 10,000,000 bbl of vital fuel oil to the scarce supply for powering locomotives and ships. Development of connecting lines at Rio Vista dry-gas fields, Sacramento Valley, Calif., one of the world's largest, will make it possible for PG&E to consume 62,000,000,000 cu ft of gas, as compared with 27,000,000,000 burned last year by the steam plants.

The Lamme medal, awarded annually by Ohio State University to one of its alumni for outstanding engrg achievement, was won this year by Harry M Williams, vicepres, National Cash Register Co, in charge of engrg and research.

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

Planned Flexibility

THE contractors on this building were foresighted. They planned an electrical conduit system that would provide maximum flexibility for all future wiring needs --and they installed Youngstown BUCKEYE CONDUIT, as this picture shows.

For maximum flexibility in YOUR new post-war wiring jobs, or in jobs replacing wartime emergency wiring, install full-weight rigid steel conduit in such a way as to anticipate all possible future needs and changes.

Youngstown's BUCKEYE CONDUIT, installed in any building, provides a permanent, safe and easy method of increasing or varying wiring circuits at any future time. In fact, BUCKEYE CONDUIT outlasts the buildings in which it is used and gives complete protection against short circuiting or arcing from vibration, dirt, dust, moisture, or corrosion. In exposed spots its rigid, full-weight steel walls protect against crushing or other mechanical damage.

BUCKEYE CONDUIT is preferred by electrical contractors in all parts of the country for its unvarying quality and strength. It will soon be available at all distributors again.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

Ask your distributor for Youngstown Buckeye Conduit...Pipe and Tubular Products...Sheets...Plates...Electrolytic Tin Plate...Coke Tin Plate...Bars...Rods...Wire...Nails...Tie Plates and Spikes.

YOUNGSTOWN

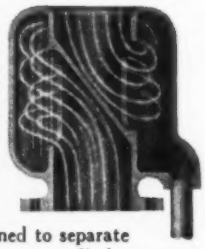
THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

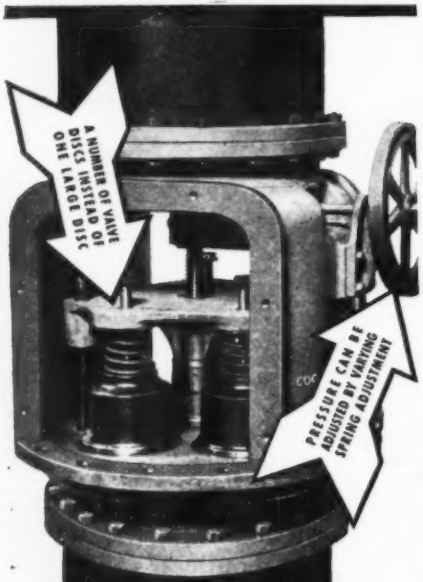
Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

COCHRANE Exhaust Head



Incorporates a highly efficient free-flowing baffle type construction and large port area to minimize back pressure. The Cochrane Exhaust Head is designed to separate condensate and oil from steam discharge to atmosphere and prevent raining of water and oily condensate on the roof. Ask for Publication 2960.



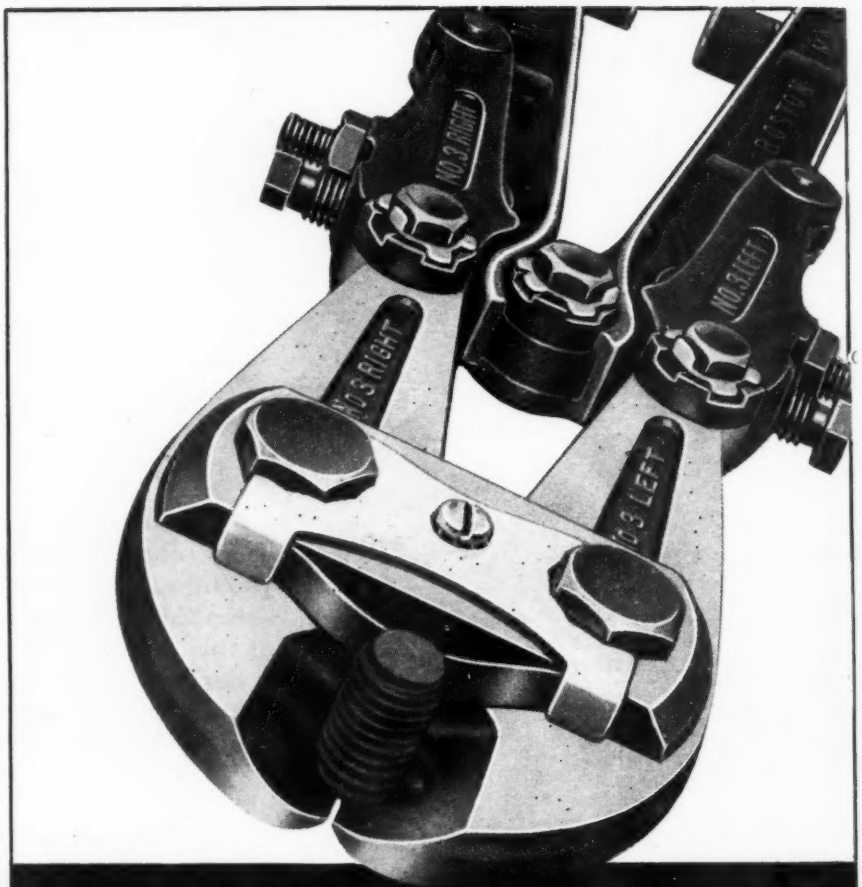
The Multiport principle of using a number of small discs instead of one large one eliminates sticking, freezing and jamming common in single disc valves used to control atmospheric relief, back pressure, etc.

Cochrane Multiport Valves have been giving successful service for many years in more than 12,000 plants. Ask for Publication 2870.

COCHRANE CORPORATION
3106 N. 17th St., Phila., Pa.

Cochrane

MULTIPORT RELIEF VALVE



PORTER TWO-HAND CUTTERS

NO OTHER POWER REQUIRED

Porter cutters save time and labor whether used on repairs, construction, production, or in emergencies.

Rod, bolt, flat bar, cable, wire, and chain cutting; flush, overhead, on floor, etc., are only a few of the operations easily and quickly performed by hand with Porter standard cutters. Porter special tools for heading, pressing, crimping, punching, and caulking are equally efficient.

Write for Porter Catalog, illustrating and describing the Porter line — also a free copy of Tool Maintenance Book — a practical manual on the use and care of clippers, saws, chisels, files, and other hand tools. A request on post card or letterhead will bring it without charge.

H. K. PORTER, INC., 425 Ashland St., Everett 49, Mass.

PORTER HKP CUTTERS

Men
Methods
Materials
STRATEGY FOR VICTORY
Military manpower trained and hardened for battle ... skilled strategists to plan and coordinate the massive onrush of fighting strength ... and *you* backing them up at home by buying the bonds to provide the weapons needed to crush the Axis forever. These are the *men*, and *methods* and *materials* that will pave the way to peace.

You get insulation efficiency the same way

● All the elements *properly coordinated*—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN ... The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS ... Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all possible methods of application.

MATERIALS ... The right insulation material to meet your specific temperature control problem. The Ruberoid insulation line has no "gaps" in it from 0° to 1900° F.

Write for Ruberoid Insulation Guide and technical data.

The RUBEROID Co., *Executive Offices*, 500 Fifth Avenue, New York 18, N.Y.

ASPHALT AND ASBESTOS BUILDING MATERIALS

Don't risk damage to tube cleaners and hose

Kinking tube cleaner hose to shut off air is poor practice at any time, especially now, when hose is a critical material. Besides ruining the hose, small hose-particles may peel off and clog the motor.

Why risk damage to tube cleaners and hose by kinking the hose to control the air. A Roto Operating Air Valve attached to the tube cleaner motor, enables the operator to control the air safely, entirely by himself. This inexpensive valve speeds up tube cleaning and releases a helper for other work. Our complete line of modern, efficient tube cleaners will meet practically every requirement. Write.

The ROTO Company

145 Sussex Ave., Newark, N. J.

A DIVISION OF ELLIOTT COMPANY

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and
. . . you'll use it always

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

THE ALLPAX CO., INC.

Mamaroneck, N. Y.

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Distributors Everywhere

Cut heat loss with RANAREX*

LET Ranarex* show you how to cut heat loss as much as 20%. Install this CO_2 indicator and recorder and measure the CO_2 in flue gas. Then regulate combustion until the percentage is at precisely the point determined to be correct for your load. This gives you the last bit of power possible from the fuel you burn.

The Ranarex instrument is rugged because it contains no chemicals or fragile parts. Yet it is so sensitive that it gives almost instant readings within 3/10 of 1% accurate. It requires no skill to operate it.

GET FREE BOOKLET

Take this first step toward fuel conservation today. Write for free booklet to The Permutit Company, Dept. A, 330 West 42nd Street, New York 18, N. Y. In Canada: Permutit Company of Canada, Ltd., Montreal.

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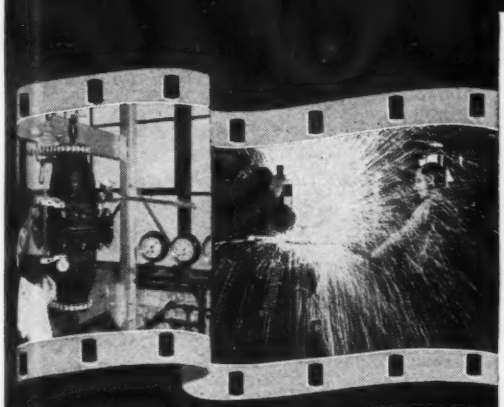
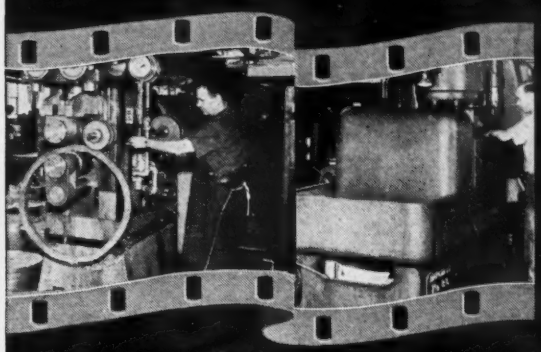
Announcing the Goetze Gasket Film

"Only A Gasket"

with Commentary by
LOWELL THOMAS





Now released for showing throughout the country.

Available to employee groups, technical societies, engineering schools, and other organizations.

This 35-minute, color and sound film tells the story of the tremendous importance of these "biggest little things" in Industry. Of the research and manufacturing facilities employed in this highly-specialized business of sealing the joints in vital equipment against the effects of high temperatures, pressures, corrosion and other service conditions.

Write for full information.

GOETZE GASKET & PACKING CO., Inc.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

USERS agree in saying "ALL'S WELL with CRYER TRAPS"

Here are a few recent typical reports from plants where CRYER BUCKET TYPE TRAPS are in service.

. . . "they stand up under most any conditions—need very little care" (this from a plant using between 150 and 200 CRYERS, some of which have been in service for ten years).

. . . "price reasonable, spare parts always available, good service" (from a plant that uses about 500 CRYERS and bases its report on five years experience).

If you are interested in the kind of service that involves little or no maintenance and attention, give serious consideration to the actual experience of CRYER users. These plants are definitely sold on CRYERS for all applications. From all sides we get the same story "All's Well with CRYER TRAPS."

SPECIFICATIONS
Sizes: ½" to 2½". Capacities: 500 to 38,000 lbs. of water. Pressure: 0 to 250 lbs.

We carry all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

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366 Madison Ave., New York, N. Y.

Manufacturers of steam specialties for over 40 years.

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Name .....

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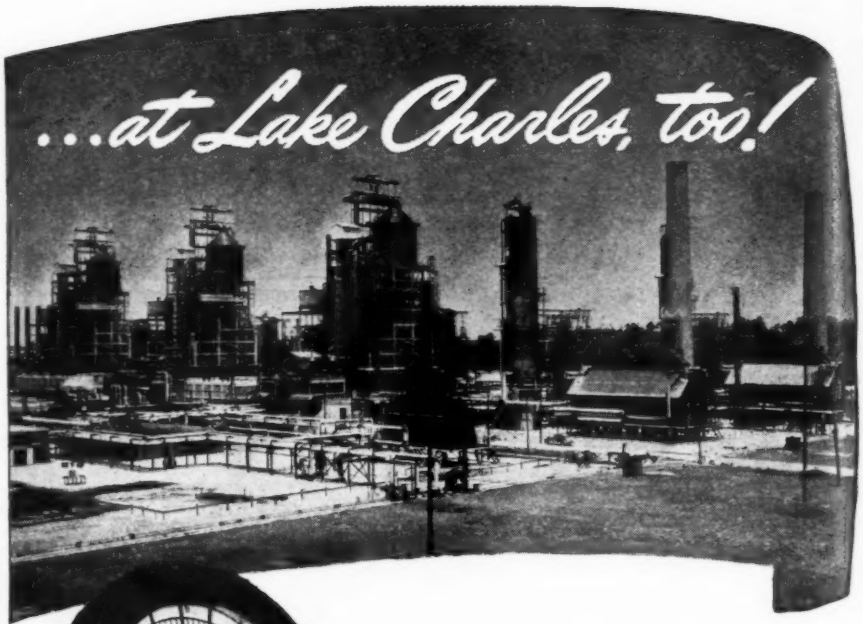

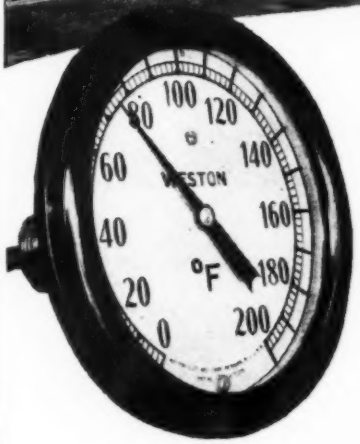

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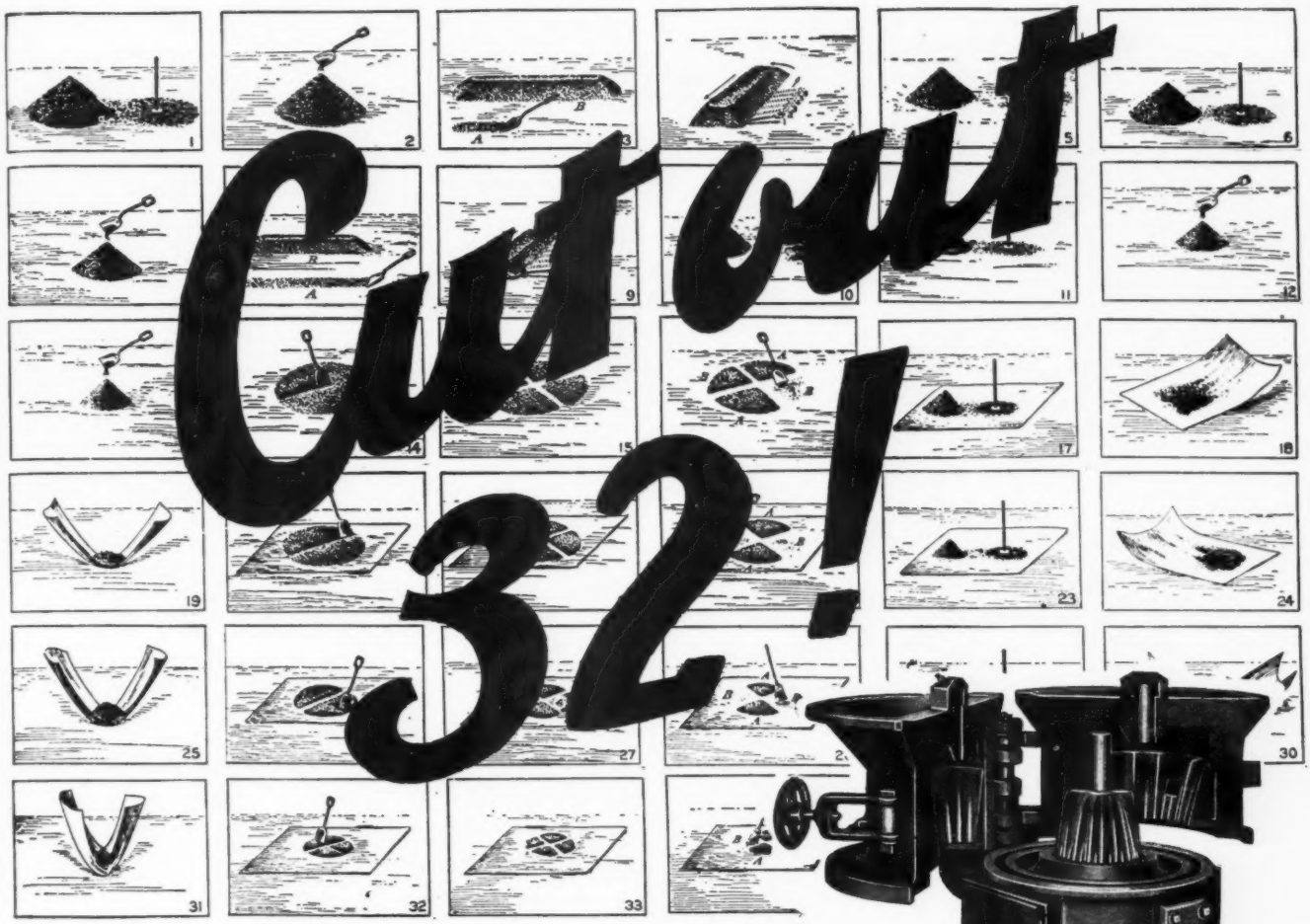
all-metal thermometers are used at critical checking points!

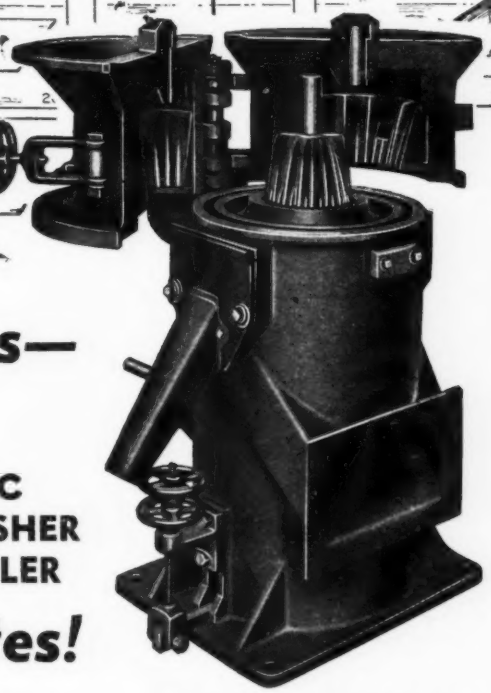
● At this new Cities Service refinery the familiar, legible faces of WESTON temperature gauges appear at hundreds of critical checking points. Here, too, their selection was based not alone on the extreme legibility of their boldly marked gauge-type scales, but also on their *proved* all-metal temperature principle. This all-metal construction contributes extreme ruggedness, of course; but it also enables these thermometers to maintain their high initial accuracy *far longer* . . . because of the absence of gases, liquids, capillaries, and other troublesome parts.

WESTON all-metal temperature gauges are available in various sizes and stem lengths for industrial applications . . . as well as in models for laboratory use. Ask for literature today . . . Weston Electrical Instrument Corporation, 682 Frelinghuysen Ave., Newark 5, N. J.

WESTON *All Metal* TEMPERATURE GAUGES



Cut out 32!



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Does a day's work in minutes!

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. . . Truck Over Immediately

Here's a new, fast way to patch broken concrete without having to close off the area. Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

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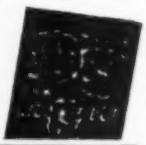

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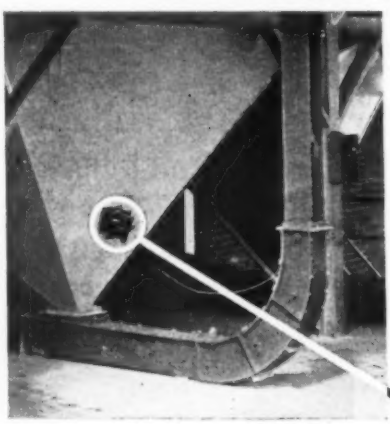
MAKE STUBBORN, WET COAL FLOW FREELY THRU BINS, BUNKERS & CHUTES



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Eliminate pounding and sledging.

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8 Models, each with rheostat control of power—from a little 4 lb. size up to big 500 lb. models, with capacities of from 1 cu. ft. hoppers up to big 100 ton bins. Operate from 110, 220, or 400 volt AC current.

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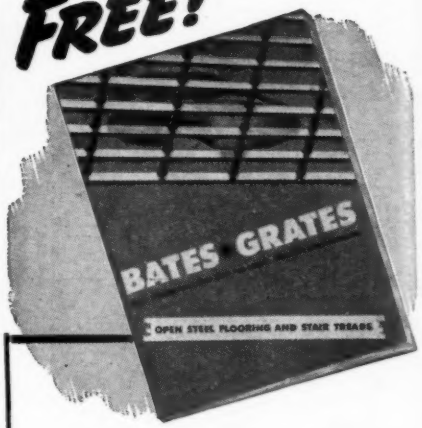

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"The best guide in the industry for open steel flooring construction." That's what hundreds of plant managers and superintendents call the new **BATES • GRATES** illustrated catalog. It's particularly valuable now for making necessary structural changes. And, it gives you vital information on how to improve plant design.

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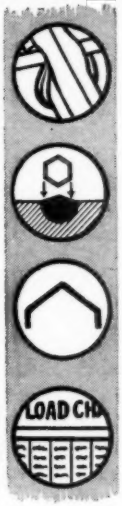

How to increase the strength and load-carrying ability of your steel treads and flooring.

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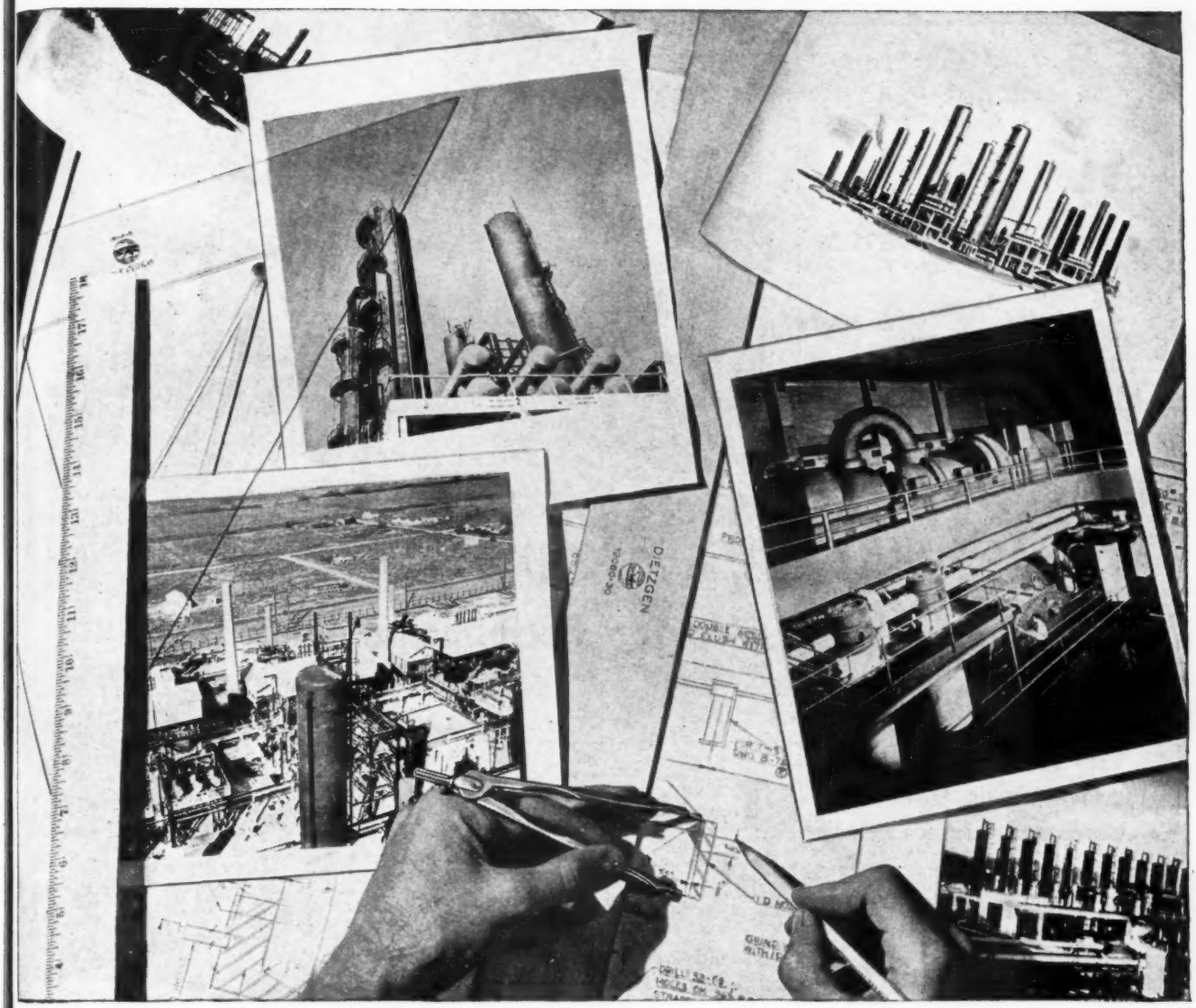
OPEN STEEL FLOORING • STAIR TREADS



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HEAT transfer equipment does a critical job—closely related to costs, safety and results.

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With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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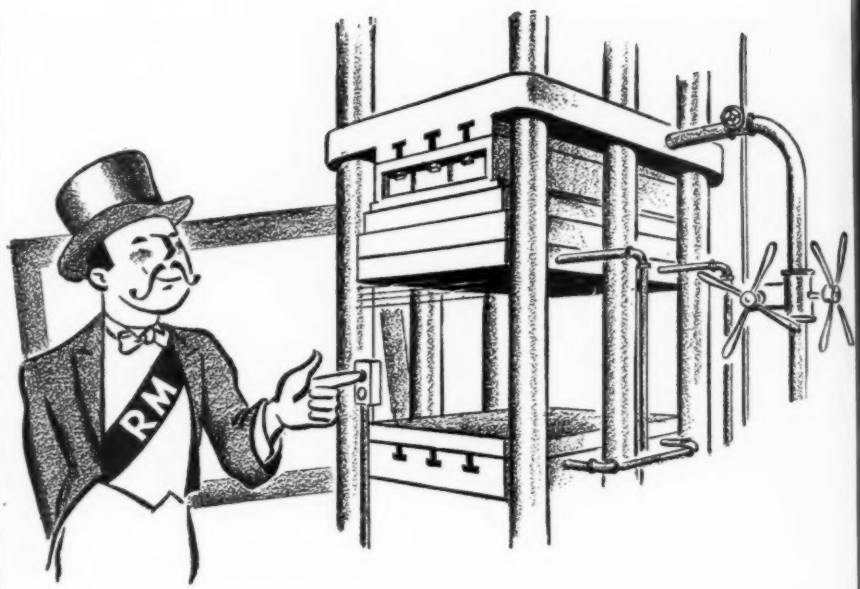

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Give Top Performance Under Pressure

Transmitting the push of a button into tons of pressure calls for tight packings all along the line. Hydraulic equipment, pumps and pipes for all kinds of fluids, boilers and engines call for tougher packings today than ever before. Under these abnormal conditions of forced production, R/M packings are helping to keep war-weary equipment steadily at it.

As we approach the end of the struggle, more and more R/M products will be diverted to meet normal industrial requirements. Once again you will find R/M has the economical answer to every packing and gasket problem.

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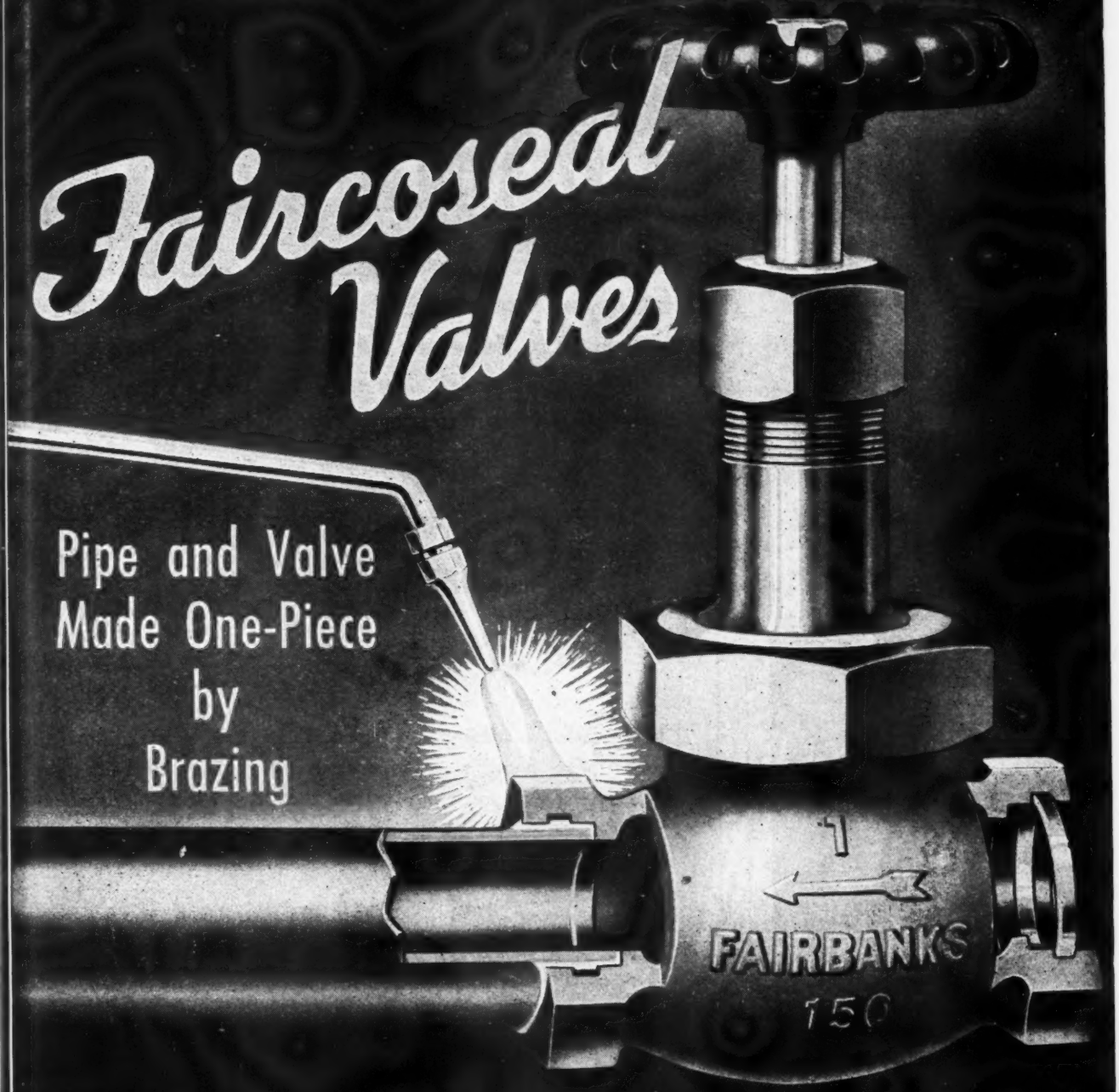
Makers of Packings for Every Industrial Use

Faircoseal Valves



Pipe and Valve Made One-Piece by Brazing

Fairbanks Faircoseal Bronze Valves contain preinserted rings of Sil-Fos silver brazing alloy in the port openings. By applying an oxy-acetylene flame the valve and non-ferrous metallic pipe can be easily brazed together, forming Silbraz joints.

These permanent, leak-proof Silbraz joints will withstand more tension, compression, torsion, vibration and corrosion than the pipe. They will not pull apart at any temperature that can be safely applied to the valve or pipe — yet they can be taken apart, if desired, by reapplying heat.

Faircoseal Valves are made in various types for steam working pressures from 125-300 lbs. Write for Bulletin No. 33.

THE FAIRBANKS COMPANY

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BOSTON, MASS. PITTSBURGH, PA.

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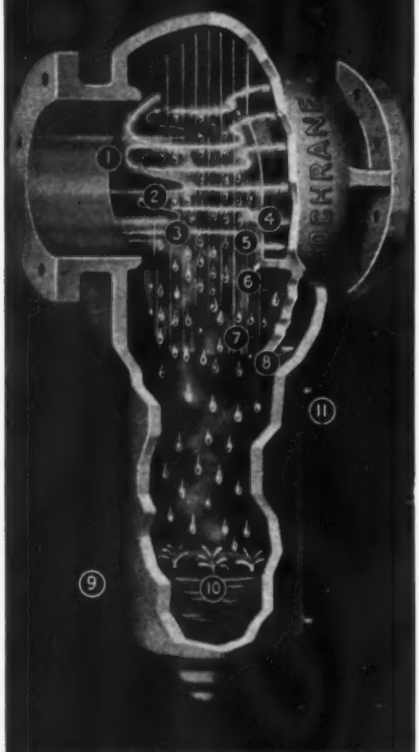
ALL-SERVICE
SEPARATOR

the most widely used and most successful type of separator for removing oil or water from steam or air...



1. Exceptional Port Area
2. Complete Removal of Entrainment
3. Self Cleaning
4. Purified Steam or Air Does Not Contaminate Entrainment
5. Steam or Air is Whipped Sidewise by Ports at Side of Baffle
6. High Ribbed Edge of Ports Prevents Entrainment Passing Baffle
7. Entrainment has Direct, Unrestrained Fall
8. Separating Shell
9. One Piece Construction
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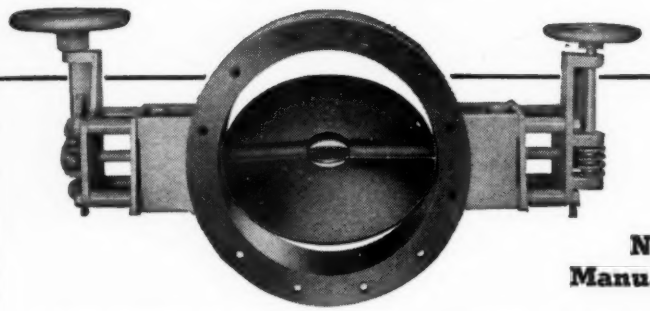
A Single Valve with a DUAL PURPOSE

(PATENT APPLIED FOR)

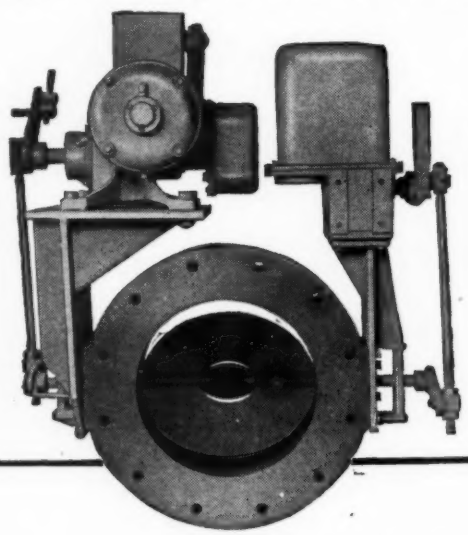
Designed for Either a High Pressure Drop and Small Volume or a Low Pressure Drop and Large Volume

Operates Beyond the Limitations of a Single Valve



No. 608
Manual Control

Close control of volume and pressure can be obtained with this dual-purpose hand wheel operated R-S Butterfly Valve. The large vane seats against the body of the valve while the smaller vane is free revolving. Both vanes are hand wheel operated. Only four to six revolutions of a hand wheel are required for complete opening or closing.



No. 583
Power Control

15 to 900 psi

Detailed information and catalog furnished upon request.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia 44, Penna.

R-S Streamlined BUTTERFLY VALVES

"I'm glad I sent for this Bulletin . . "

"It's started something — and I'm going to finish it!

"Back in the days before Pearl Harbor I never worried about valves. It was too easy to get replacements. We sent the big ones back to the factory, and we sold the little ones for scrap!

"But now . . . it's not that easy. Valve plants are busy with Triple-A production — new valves are hard to get — labor is scarce and expensive. And three-shift operations don't give us much time for needed repairs.

"This bulletin tells about the Dexter Valve Reseating Equipment that reseats a valve without removing it from the line. One man can operate it . . . No costly shut-downs . . . no troublesome replacements . . . no red tape."

★ ★

You, too, can handle the leaky valve problem from *start to finish* with Dexter Valve Reseating Equipment. No heavy investment — no factory training needed. Complete photo-instructions furnished. Write today — tell us about your most troublesome valve and let us suggest the Dexter Outfit that will put it back in service quickly — and inexpensively.

FOR GLOBE, GATE AND PUMP VALVES

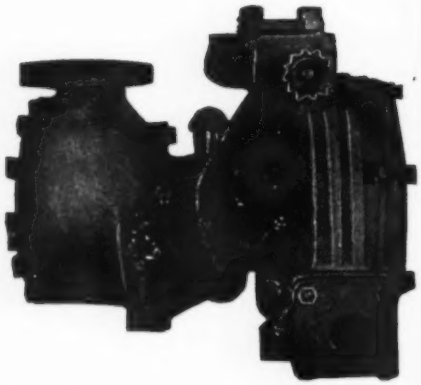
DEXTER VALVE RESEATING MACHINES AND CUTTERS

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

The COFFIN-Steam Turbine CENTRIFUGAL PUMPS

For Boiler Feed and general high pressure service.

See previous issue for details



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ENGLEWOOD, N. J.

The MOST PUMP in least Weight & Space
IMO
IMO MOVE OIL
The De Laval-IMO pump for fuel oil and "lube" oil services is distinguished by compactness and simplicity. There are only three working parts which are in complete hydraulic and rotational balance and which propel the oil without pulsation, like a piston moving steadily forward. There are no valves, no gears, no cams and no reciprocating parts. The one packing is under suction pressure only and is easily accessible. Any quantity of oil is delivered against any pressure.
Ask for Publication I-111
IMO PUMP DIVISION
of the De Laval Steam Turbine Company
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MERCOID

The Only 100% Mercury Switch Equipped Controls

FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

Mercury switches are the most advanced means for "making" and "breaking" an electrical circuit. They are not affected by dust, dirt or corrosion.

See catalog No. 600 for description of complete line

DA PRESSURE CONTROLS

Industries' first choice for dependable control performance. The outside adjustment and visible dial eliminate all guesswork when setting the operating range.

LIQUID LEVEL CONTROLS

Available for gasoline, oil, ammonia or other low specific gravity liquids. Also for liquids at high pressures.

MERCURY SWITCHES

Mercoid brand switches are noted for their superior operating qualities. Various types available.

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Used on a variety of industrial temperature applications. Have same adjustment feature described above.

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Used for maintaining fluid levels in tanks or for control of sump pumps, etc. Two types, the counter-balance type and plunger type available.

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YOUR ANSWER for speeding wartime MAINTENANCE

Minimizing Scale On Evaporative Condenser Coils

Unless formation of lime scale on the exterior coil surfaces of evaporative condensers is prevented by proper treatment of spray water, you are likely to run into trouble . . . particularly in hard water areas. Heat transfer efficiency will be seriously impaired.

Use this corrective treatment . . . introduce Oakite Composition No. 82 in spray water. It will reduce precipitation and result in only a soft slush forming that is easily removed by rinsing.

DIGEST Gives Data!

New Power Plant Digest contains helpful data for removing scale already formed or for the cleaning of inside coil surfaces. Write for your FREE copy today.

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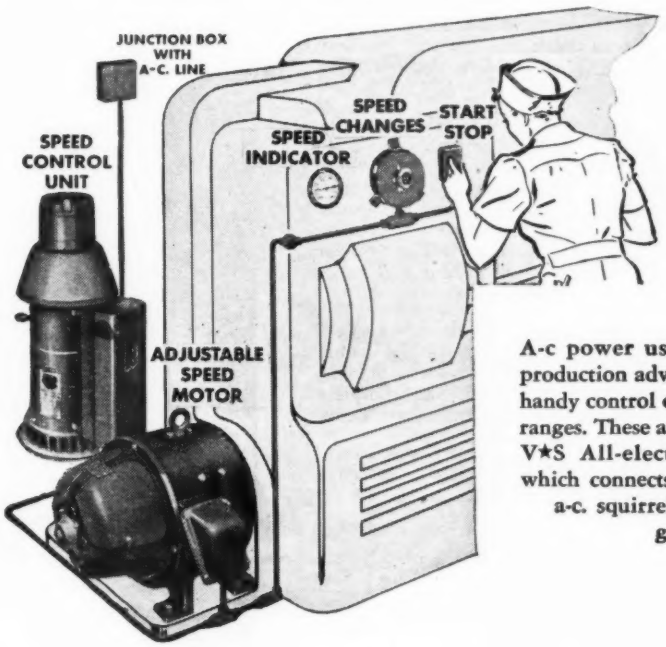
The possibilities of improved machine efficiency with properly applied Motor-drive are very great. Reliance engineers have done some interesting and resultful work in this field. Perhaps a review of them would produce some ideas profitable to you. Just phone or write our nearest office.



A-c power users can now enjoy all the production advantages gained with easy and handy control of operating speeds over wide ranges. These are obtained with the Reliance V★S All-electric Adjustable-speed Drive which connects to the same outlets as your a-c. squirrel-cage motors. For details get Bulletin 311.

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RELIANCE ELECTRIC & ENGINEERING CO.

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2—Easy to inspect. Equipped with single seat renewable discs of composition or metal; stainless steel valve stem; and removable diaphragm top.

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For nearly a half century ATLAS has specialized in regulating valves for every service. What are your regulating problems? We shall be glad to send you useful data on this or other ATLAS products. Use the coupon below.

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Address .....

TRY AND DO IT!

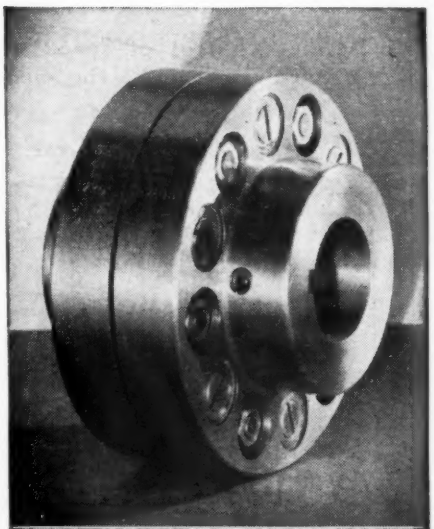
This 10-second test will quickly show you why a flexible coupling is mighty important to the life of direct-connected machines.

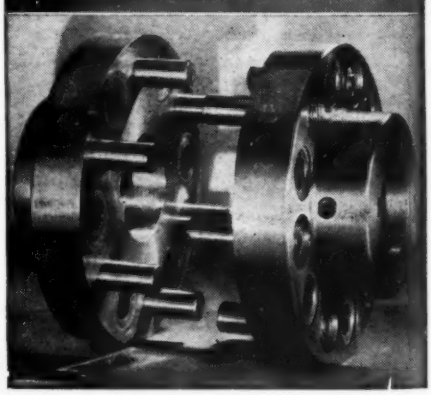
Just try to hold a couple of pencils in perfect alignment without touching each other, and see what happens.

Ajax Flexible Couplings provide a positive but resilient connection between driving and driven shafts. They make it possible for each shaft to rotate around its own axis without creating vibration, chatter, strain on bearings, drag, power loss, reversal of torque and other detrimental features.

Ajax interlocking drive studs held by rubber-bushed, graphited-bronze bearings assure maximum flexibility, quiet operation, and complete elimination of lubrication problems.

Make the 10-second "pencil test" —then write for Facts on Ajax Flexible Couplings.





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Flexible Coupling Co.
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Score another ZERO for the ZERO

On split-second timing and split-thousandths accuracy, Lombard High Pressure Manifold Valves send our submarines to safety hundreds of feet below the menace of the Japs . . . scoring another zero for the Zero.

Other precision products such as Pumps, Valves and special power and control equipment, resulting from Lombard's 50 years of hydraulic engineering experience, serve our country on land, and sea.

In the days of peace ahead, these and other products such as Lombard's new Variable Speed Drive and the famous Lombard Water Wheel Governor will again demonstrate Lombard's leadership in hydraulic and control engineering. Write for engineering bulletins.

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SERVE THIS LARGE EASTERN SEMINARY

Theological Seminary of St. Charles Borromeo

Three Series 60, "F&E" Underfeed Stokers, under 265 horsepower Heine boilers, provide heat and power for the Theological Seminary of St. Charles Borromeo in Overbrook, Philadelphia, Pennsylvania.

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F&E UNDERFEED STOKERS

FOR BOILERS PRODUCING 1,000 TO 40,000 LBS. OF STEAM PER HR.

are manufactured by

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View of the boiler room showing the 3 "F&E" Underfeed Stokers—an installation that makes this a strikingly efficient and economically operated plant.

YOU GET *ALL*

OF THESE IMPORTANT FEATURES *ONLY* IN "F & E" STOKERS . . .

1. Dependable Electro-Hydraulic Drive. Foolproof . . . has only 5 moving parts.
2. Patented "F&E" Interval Timer Governor . . . provides perfect control of fuel feeding rates.
3. Sliding Bottom Retort—for even fuel distribution.
4. Exterior Fuel Bed Regulator.
5. Removable Ram Case Liner . . . lowers maintenance and replacement time.
6. High Efficiency Tuyeres—scientifically designed . . . made of heat-resisting metal.

The Power Plant News
FINAL
CHEMICAL ENGINEERS LOCATE MECHANICAL DIFFICULTIES
Tube Burn-outs Eliminated by Modification of Boiler Design

The amount of money saved by preventing boiler outages can be astonishingly large. For example, essential production in a large eastern paper mill was interrupted all too frequently by tubes burning out in a high pressure 4-drum boiler. Use and occupancy insurance cost the underwriters several thousand dollars for these outages. No immediate solution to the problem was apparent and Betz engineers were consulted.

A thorough study of the problem showed that satisfactory chemical balances were being maintained in the lime-soda softener and boiler water at all times. However, a detailed check of the boiler design revealed that incoming feed water was circulating directly to the hottest generating tubes with the result that rapid scale formation and cyclic disintegration in these tubes were responsible for the recurring burn-outs. A modification of the design for feed water delivery was recommended and adopted. Tube burn-outs ceased immediately.

Although this is a rather unusual case it nevertheless illustrates the breadth of experience behind the Betz organization for keeping boilers "on the line".

CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

W. H. & L. D. BETZ
FRANKFORD · PHILADELPHIA · PENNA.

BETZ

Cochrane Corporation
3106 N. 17th St., Phila., Pa.

Please send me a copy of your new Publication on Carbite Softeners

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Will CARBONACEOUS ZEOLITES apply to your softening problems?

Cochrane's new Publication 4021 contains a wealth of material of great value in estimating the applicability of this system in the solution of your water conditioning problems.

A Partial List of Contents:

APPLICATIONS
CHEMICAL REACTIONS
SODIUM CYCLE SOFTENING
ACID CYCLE SOFTENING
BLENDING
DECARBONATOR
TYPICAL ANALYSIS
TYPICAL INSTALLATIONS
CONTROL MEANS FOR BLENDING

Use Coupon in upper left corner or write giving details of specific problems.

COCHRANE CORPORATION PHILADELPHIA, PA.

COCHRANE

SOFTENERS · DEAERATING SOFTENERS · DEAERATORS · METERS · STEAM SPECIALTIES

NO OTHER SWITCH HAS THESE TWO GREAT FEATURES

INSIDE—*note the trim compactness and ample wiring space.*

OUTSIDE — *modernly streamlined cover with rocker design handle.*

All BullDog Safety Switches have two important (and exclusive) advantages which assure more positive action, greater safety and longer life.

First, the Vacu-Break principle gives arcs no space in which to breathe — snuffs them out before they start.

Second, the Clampmatic mechanism — bolt-tight in the ON position—makes possible an easy, quick release when thrown OFF. This is accomplished by the energy stored in the clamp springs which help the handle operating spring "break" the contacts with almost automatic ease.

Send for descriptive Bulletin No. 415, giving complete information.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

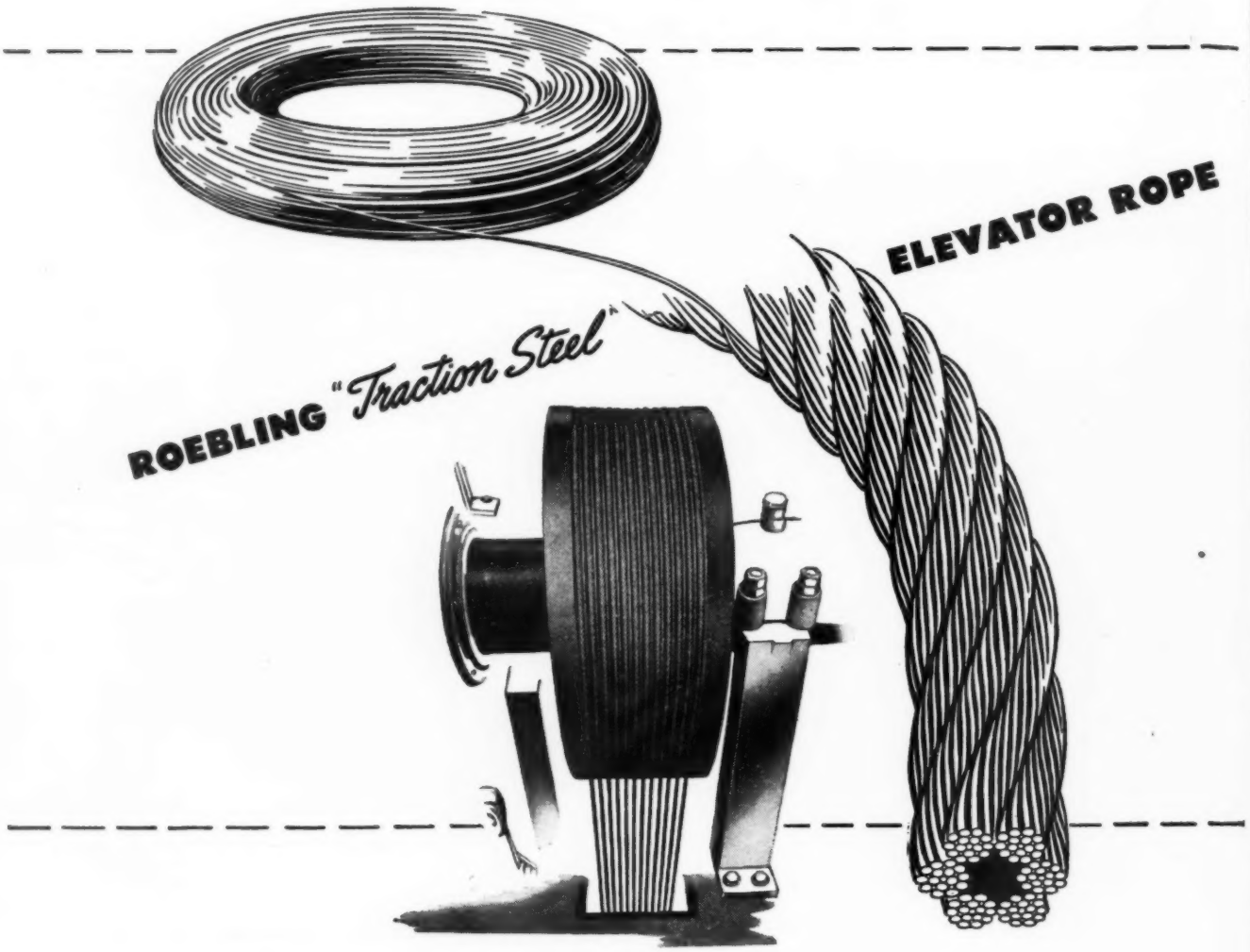
Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF

SAFTOFUSE PANELBOARDS • SWITCHBOARDS • CIRCUIT MASTER BREAKERS • BUSTRIBUTION DUCT, *for "plug-in" power* **• UNIVERSAL TROL-E-DUCT,** *for flexible lighting* **• INDUSTRIAL TROL-E-DUCT,** *for movable "loads."*

BUY MORE WAR BONDS

50 feet of elevator rope — over a mile of fine steel wires, each of which we have painstakingly drawn and stranded and laid up so that they will work together



YOUR building's profits depend in part upon keeping elevators operating continuously, at lowest cost.

WHAT CAN YOU EXPECT from Roebling? Rope that has known capacity to deliver maximum service with safety. Engineering, in our plant and available for you, to put the rope to work right. Recommended maintenance practises to insure its long life and safety.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY • Branches and Warehouses in Principal Cities

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PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

TOUGH MOTOR JOB?... AND HOW!

"Double the horsepower, increase pumping capacity 50%, cut the weight to one-third."

These were the requirements when Star resumed production of submersible pumps for the Navy at the outbreak of the war. Developed by Star after the first World War, pumps were required to deliver water at a rate of 135 gallons per minute at a head of 35 feet—to operate only a few hours at a time. And now—*double* the head to 50 feet—*increase* delivery to 180 gallons per minute, provide continuous operation!

Star engineers—Specialists in "TIGHT SPOTS"—met the requirements and surpassed them—with motors that exceed the pumping requirement of 180 gallons per minute—that have operated continuously on test 6271 hours at a time, to pump 75,252,000 gallons of water. That's 314,365 *tons* of water—and still going strong!

Perhaps you'll never need a motor to meet such extreme needs. But isn't it a satisfaction to know that your motor requirements can receive the same STAR engineering?

STAR ELECTRIC MOTOR COMPANY • BLOOMFIELD, NEW JERSEY

• Time: October, 1943. Scene: The Coral Sea. An American cruiser is torpedoed; water is pouring in through a huge hole below the waterline. Forward gun turrets have been shot away. Powder-fed flames leap mast-high. Jap shells inflict additional damage as the cruiser turns from the scene of battle, supposedly in sinking condition. But she doesn't sink! Submersible pumps go into play as seamen stuff gaping holes with blankets, mattresses; shore up bulkheads. With the help of Submersibles the battle with the sea is won, the U. S. Cruiser lives to fight again.

POWER PACKAGED AS YOU NEED IT

STAR MOTORS

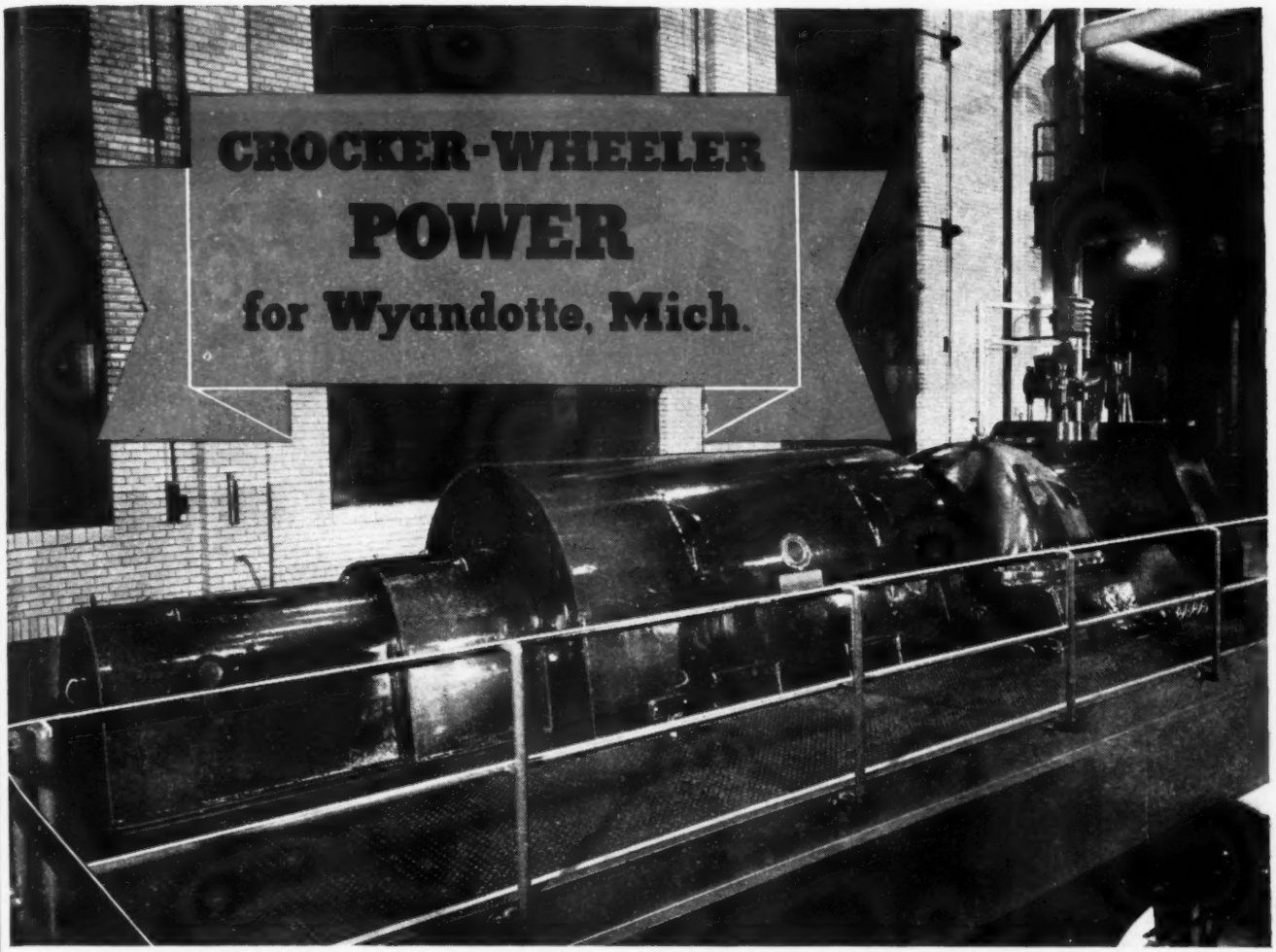
It's easy to inspect SUPER-SILVERTOPS

Remove six bolts, slip off the outside case and you're right inside a Super-Silvertop for inspection, and inspection is good engineering practice. You don't have to take it off the line, and it's just as easy to install or move Super-Silvertops. They require only one fitting whether installed as an elbow or straight-in-line. You save an hour's time on each installation. It's just common sense to use these easy-to-install and inspect steam traps that give you years of dependable service in draining condensation.

Write today for a copy of the book, "How to Choose a Steam Trap." It not only gives you full details on the marvelous simplicity and accessibility of Super-Silvertops but also data and other information that will save many a dollar and hours of time on your steam trap installation. The book is free—send for it today!

THE V. D. ANDERSON CO. • 1934 W. 96th St., Cleveland 2, Ohio

Super-Silvertop
STEAM TRAPS



DEPENDIPOWER Turbine Driven Generator, alternating current, 7,500 kilowatts, installed for the City of Wyandotte, Michigan.

THE GROWING, heavily war-producing city of Wyandotte, in the Detroit area, is faced with continuously increasing demands upon its public power service.

Wyandotte is one more of the many busy American cities proving the dependability of Crocker-Wheeler Generators... for power delivery under all conditions, with low maintenance costs and cleanliness in operation.

Crocker-Wheeler Motors are also demonstrating the advantages of their liberal design, for heavy duty in thousands and thousands of war-busy plants.

Before you add equipment, let Crocker-Wheeler make recommendations for your specific needs.

Crocker-Wheeler makes a comprehensive line of electrical equipment for power plant and factory — polyphase induction motors from ¼ to 10,000 horsepower; direct current motors from ½ to 5,000 horsepower; alternating current generators up to 10,000 kva.; direct current generators up to 7,500 kva.; motor-generator sets up to 7,500 kilowatts; resilient flexible couplings for shaft diameters up to 5 inches.

• • •

Crocker-Wheeler, one of the leading companies in the field, specializes SOLELY in the design, manufacture and application of electric power equipment.

As power SPECIALISTS, Crocker-Wheeler field engineers know the power needs of your industry—of your particular production processes. Call in one of our experienced engineers for specific advice on motors, generators, control and couplings... no obligation.

CROCKER WHEELER Motors Generators

JOSHUA HENDY IRON WORKS

CROCKER-WHEELER DIVISION

ESTABLISHED 1856

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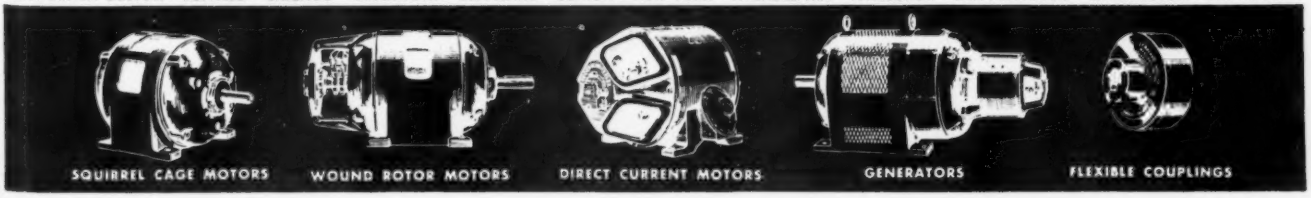
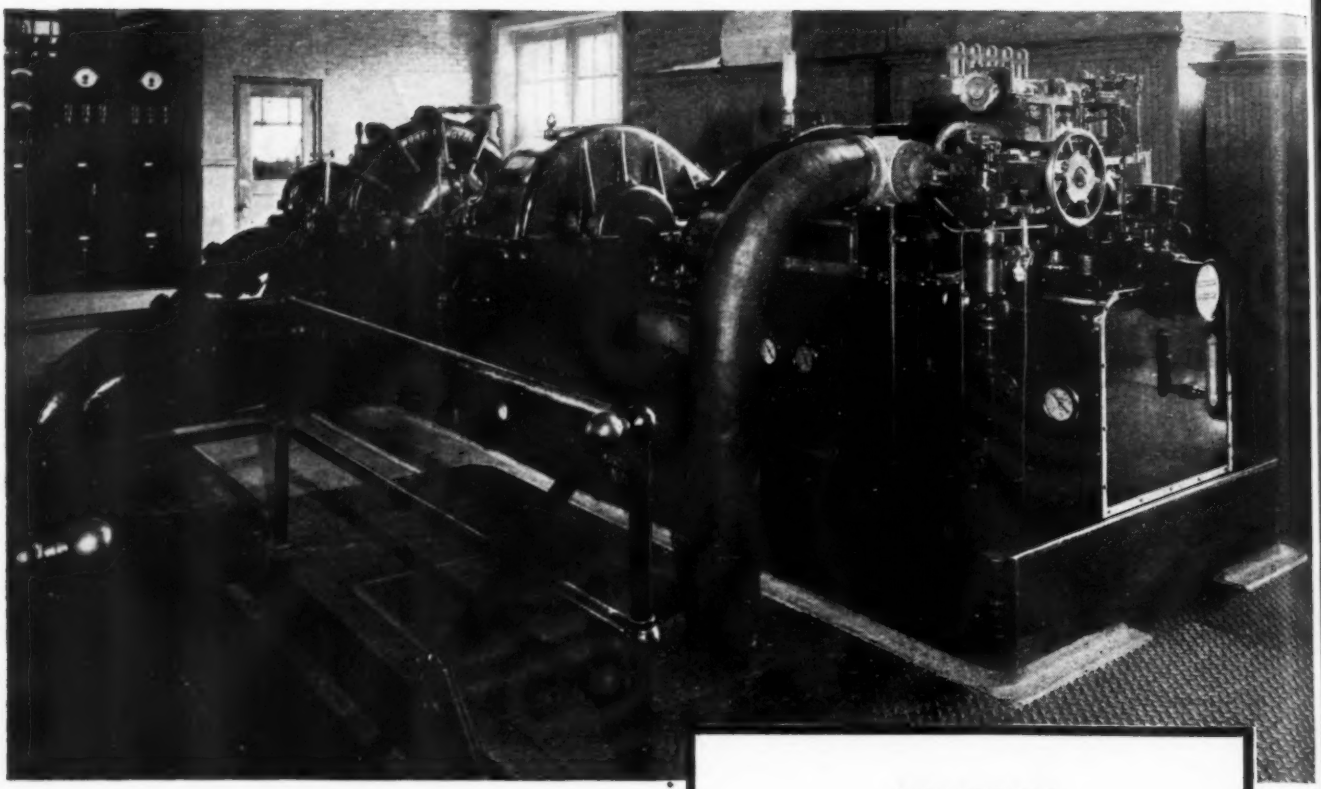


COMPLETE UNIT RESPONSIBILITY



THIS Worthington-Moore turbine-driven centrifugal pumping unit was installed by the Water Works Department of the City of Lansing, Michigan, in 1941.

Turbine, gear, main pump, condenser and auxiliaries were engineered as a unit for maximum efficiency and uninterrupted service.

A Worthington-Moore condensing steam turbine, with double-helical reduction gear, drives a Worthington centrifugal pump capable of delivering 20 million gallons per day against discharge head of 200 feet.

Worthington—world's largest manufacturer of pumps, with broad experience in steam power equipment – combined with Moore's years of turbine engineering, can build the same year-in, year-out, trouble-free service into *your* Worthington-Moore steam turbines. Write us. Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, N. Y.

ADAPTABLE
TO HIGHER STEAM PRESSURES

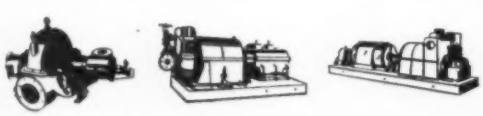
Now operating on steam at 160 lbs. pressure, exhausting to 29″ vacuum, the construction of Lansing's Worthington-Moore turbine is suitable for future steam conditions of 400 lbs. pressure and 750°F. total temperature. Automatic nozzle control permits greatest efficiency at reduced pumping rates.

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY
MOORE STEAM TURBINE DIVISION, WELLSVILLE, NEW YORK

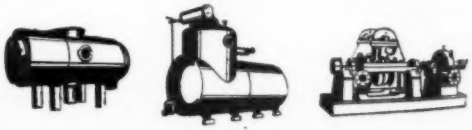
WORTHINGTON

MOORE

MR4-4



A GREAT TEAM IN STEAM



Hotter 'n a Firecracker . . .

That's what they're calling Ellsworth's High Speed Pipe Fabrication . . .

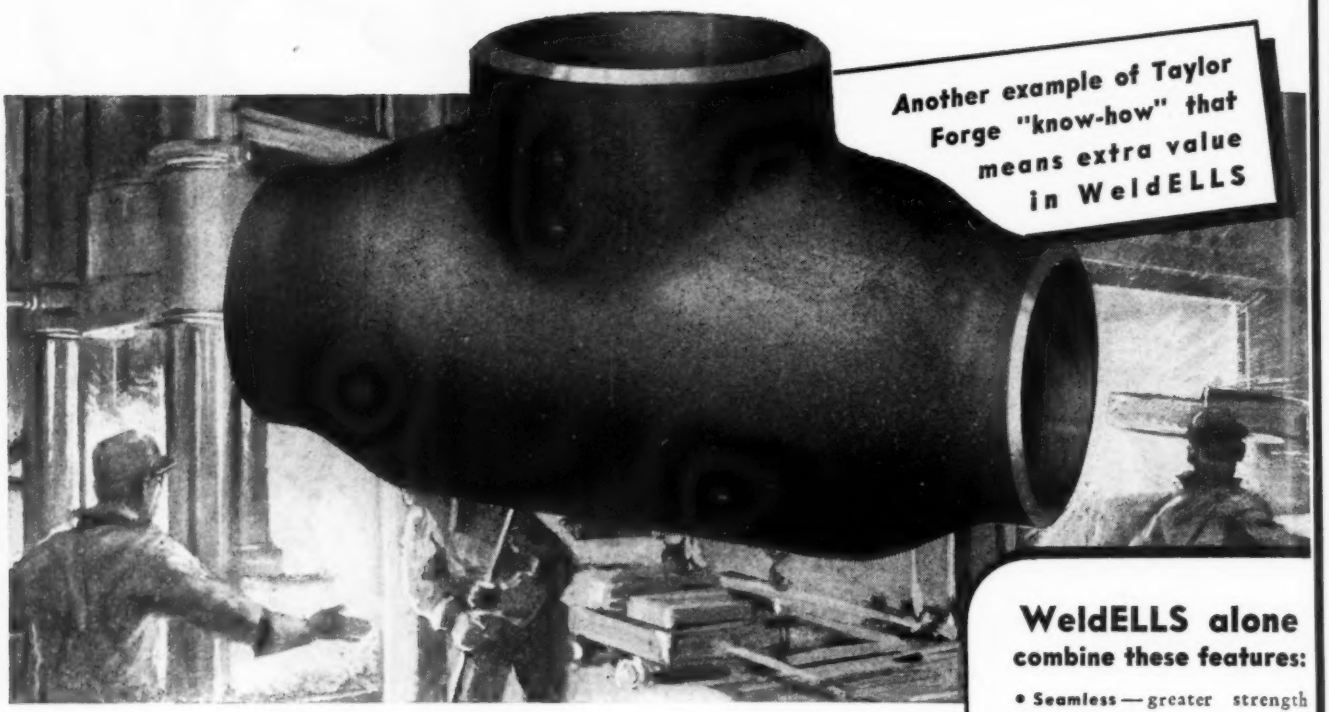
And, no wonder! For here's what Ellsworth guarantees . . . 24-hour delivery — top quality prefabricated piping and fabricated welded fittings, with Ellsworth's famous "power-sealed" welds.

Your best bet today is to put Ellsworth's high speed pipe fabrication to work for you now. Write, 'phone or wire for details.

ELLSWORTH PIPE & SUPPLY CO.

1739 West St. Paul Avenue Milwaukee 3, Wisconsin

RARE SPECIMEN IN WELDING TEES—



● *When you think of a reducing tee you always picture it as reducing in the branch. But this one, for the peculiar purpose it serves, had to be made the other way around. It's a seamless, carbon-moly forging, five inches in the run with a seven-inch branch—an "increasing" tee, so to speak; one more example of those kinks that are found so abundantly in the Taylor Forge bag of tricks.*

The "know-how" acquired during many years of performing these special—often extremely difficult—manufacturing operations, has a mighty important bearing on our standard line of WeldELLS, Welding Tees and other Taylor Forge Welding Fittings.

It means that in developing WeldELLS we did not have to ask what kind of fitting is easiest to manufacture. Instead we asked what comprises the ideal fitting, and then, with every special facility and process at our command, made that conception a reality.

That is why WeldELLS have tangents . . . why they have extra reinforcement where service stresses are greatest . . . why they have such extremely accurate dimensions . . . why they have the features listed opposite . . . why, in short,

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

SAVE COAL...

with FYR-FEEDER Multiple SPREADER Stokers

FYR-FEEDER stoker firing not only saves coal, but also permits you to burn any kind of wet or dry bituminous coal you have available locally — screenings or sweepings, any melting point of ash, free-burning or coking coals.

Burns Coal like Oil: FYR-FEEDER burns fines in suspension, burns larger pieces on grate. Coal is spread over entire fuel bed. Thin fuel bed — no clinkers. Fires can be cleaned in two minutes! Suitable for large or small boilers. Very little maintenance cost. In many cases FYR-FEEDER stokers have made it unnecessary to add another boiler to handle increased loads.

FYR-FEEDER is our own original design. FYR-FEEDER is not a copy of any other stoker but our own invention developed by us, and our engineering experience with spreader stoker design, installation and operation began in the last century.

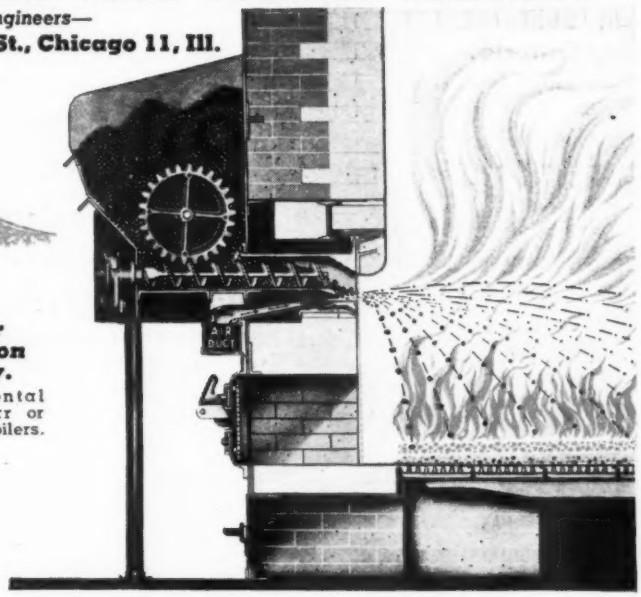
WET COAL IS NO HANDICAP

Coal men like the FYR-FEEDER because FYR-FEEDER users do not insist upon the delivery of "DRY" coal since FYR-FEEDER handles "WET" coal satisfactorily. Regardless of "rain and snow watered" coal, FYR-FEEDER stokers produce plenty of steam from "WET" coal. FYR-FEEDER was designed to use "WET" coal or dry coal.

AMERICAN COAL BURNER COMPANY

—Engineers—

32-18 E. Erie St., Chicago 11, Ill.



Wire for Information or Survey.

Specify Horizontal Return Tubular or Water Tube Boilers.

TREND TO SPREADER STOKERS

There is a definite trend to the use of more and more Spreader Stokers in small, medium and large Industrial Installations.

WHY do so many engineers now consider the Spreader Stoker superior to all other methods of coal firing?

THE FYR-FEEDER MULTIPLE SPREADER STOKER is the World's BEST Spreader Stoker.

The Best Is Vital Now

In ordinary times it is BEST to get the BEST. In times of emergency, when there is an urgent demand for saving coal and man-power, the BEST is a vital necessity.

The FYR-FEEDER Spray-Spred method of firing combines the advantages of the old-style Spreader Stoker and the Pulverized Coal Burner, using only the BEST features of each method plus other FYR-FEEDER advantageous features.

The following questions present themselves:

I. WHY is the FYR-FEEDER superior to all other types of Spreader Stokers?

II. WHY is FYR-FEEDER the World's Simplest Automatic Stoker?

III. WHY is FYR-FEEDER the best Industrial Bituminous Coal Burner?

IV. WHY and how does FYR-FEEDER save coal and man-power?

V. WHY and how does FYR-FEEDER reduce maintenance costs?

VI. WHY is FYR-FEEDER the best method of burning WET or dry "coal screenings," bug dust or yard sweepings?

Fyr-Feeder Stoker Sizes

FYR-FEEDER Multi-Burner Stokers are built in sizes that will burn from 300 to 12000 lbs. of coal per hour If you expect to be in the market for Automatic Coal Burning Equipment —WIRE

FYR-FEEDER

Spreader Stokers

Chicago 11, Ill.

© by American Coal Burner Co., 1944

AMONG PLANT ENGINEERS

PRECISION IS IMPORTANT!

Because plant engineers know and appreciate the advantages of precision construction, they naturally favor machines like the Sullivan WG-9 air compressor.

Plant engineers know that the greater capacity of the WG-9, per square foot of floor area, is the direct result of precision manufacture and the judicious use of modern, lightweight alloy metals.

They know, too, that the WG-9 is the only double-acting, single-stage compressor that provides these advantages:

1) Full force-feed lubrication to all working parts.
2) Replaceable cylinder liners and crosshead guides.
3) "Dual-Cushion" valves.
4) Anti-friction main bearings.

There are twenty more construction features on the WG-9 that appeal to men who know machinery. Your copy of Bulletin A-43, containing complete details, is ready for you. Sullivan Machinery Company, Michigan City, Indiana. In Canada: Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.

OFFICES

Seattle	Pittsburgh	Knoxville	Butte
Boston	St. Louis	Huntington	Salt Lake City
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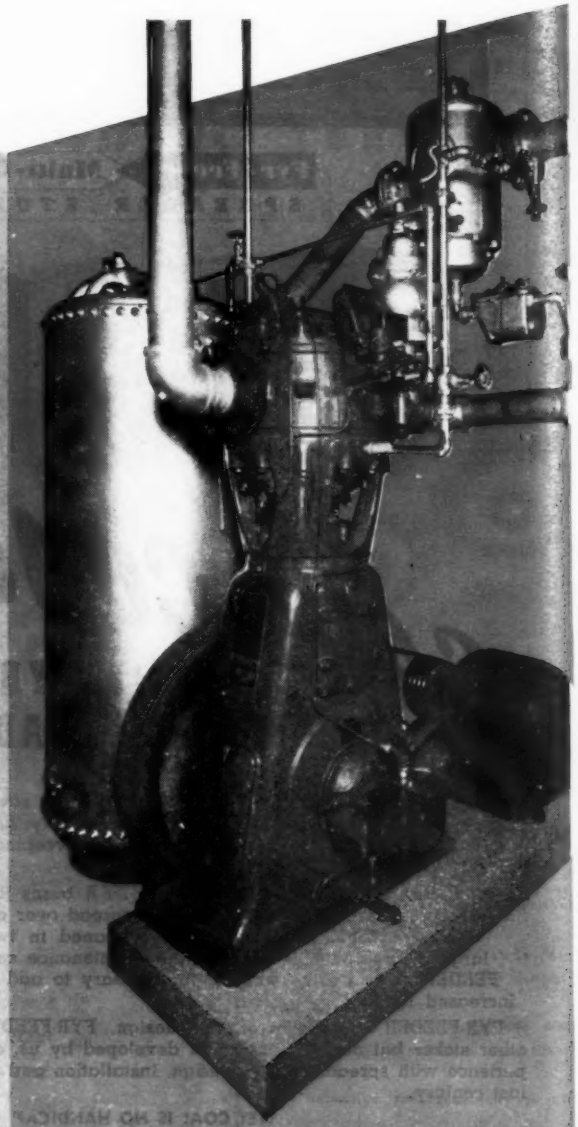
SULLIVAN
AIR COMPRESSORS

FROM ¼ TO 3,000 H. P.

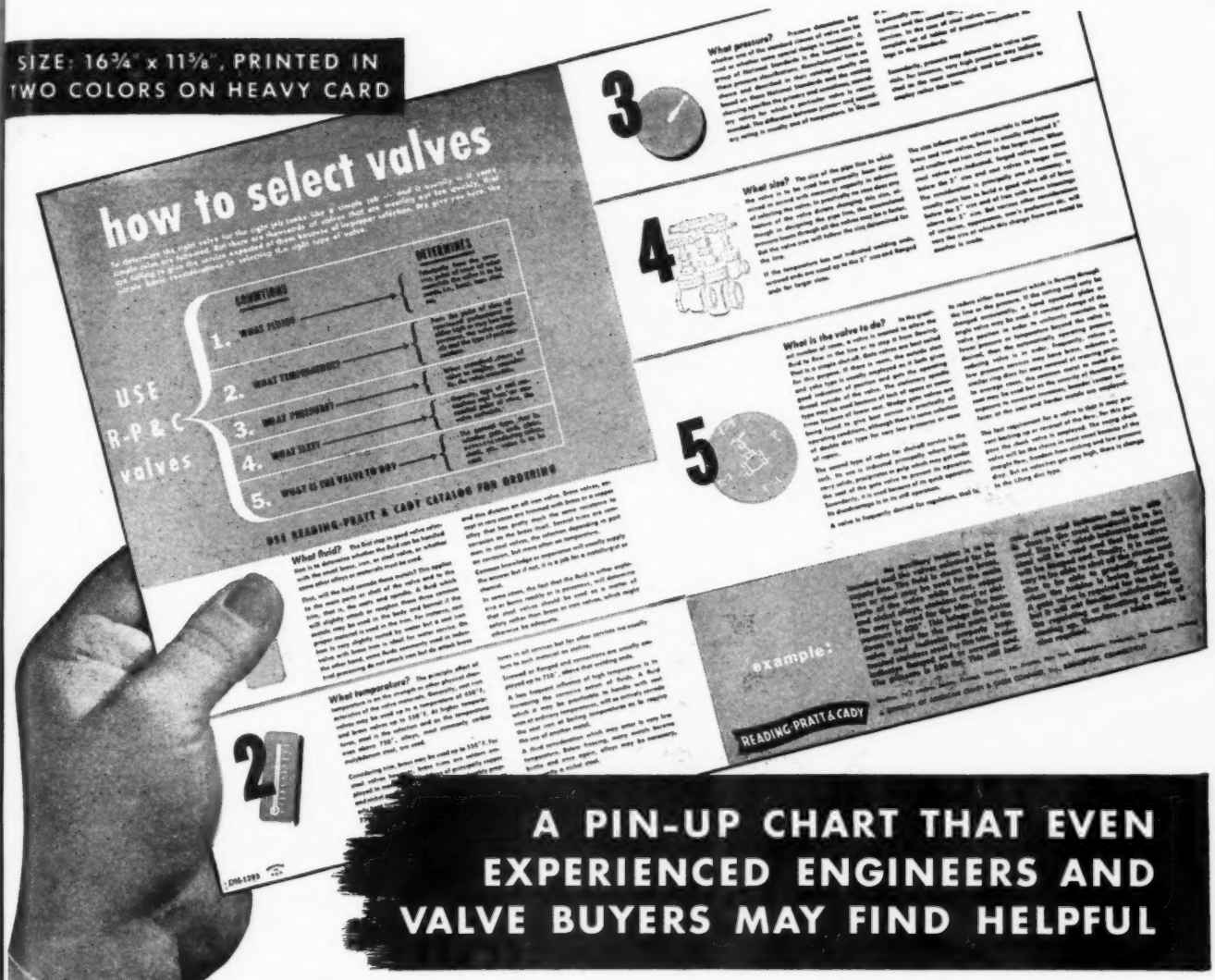


The WG-9 is designed for continuous, heavy-duty service in industries having moderate air power requirements. Available in eleven sizes, with displacements from 153 to 822 C. F. M., 30 to 150 p.s.i.

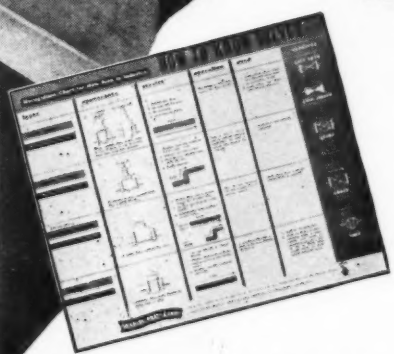
PRODUCTS

STATIONARY AND PORTABLE AIR COMPRESSORS FROM ¼ TO 3000 H. P., PNEUMATIC CASTING GRIPS, FOUNDATION BREAKERS, PORTABLE HOISTS, ROCK DRILLS.

SIZE: 16¾" x 11⅝", PRINTED IN TWO COLORS ON HEAVY CARD



A PIN-UP CHART THAT EVEN EXPERIENCED ENGINEERS AND VALVE BUYERS MAY FIND HELPFUL



HOW TO KNOW VALVES

A companion chart to **"how to select valves."** Tells how to identify quickly gates, globes, checks and cocks. Shows their distinct differences in appearance, the services to which each is suited, how each operates and where each should be used. Address Reading, Pa. office for a copy.

This easily read chart 16¾" x 11⅝" covers the 5 major considerations that determine the selection of valves.

1. **The fluid, from a corrosive standpoint, determines whether the valve should be made of brass, iron, steel, etc.**
2. **Temperatures, from the point of view of continued performance, determine valve materials and end connections.**
3. **Pressure determines the standard class to employ; and, secondarily, valve materials.**
4. **Size determines valve capacity, end connections and valve materials.**
5. **What the valve is to do determines whether to use cock, gate, globe, check, pressure-reducing valve, etc.**

This data is compressed into the READING-PRATT & CADY chart **"how to select valves."** Experienced men will find it an excellent prompter when they are discussing valves, and new men in industry will find its information an invaluable guide. Copy sent gladly. Address our offices in Reading, Pennsylvania.

READING-PRATT & CADY

MANUFACTURERS OF

READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT • CONNECTICUT

Nature made Asbestos

HERE'S HOW KEASBEY & MATTISON IS MAKING IT SERVE WARTIME CONSTRUCTION

This plant does a big job for America . . .

"Century" APAC DOES A BIG JOB FOR THIS PLANT

Above is a section of a gigantic project . . . one of the nation's leading war plants. Nearly a *million* square feet of K&M "Century" Apac sheet material is serving this mighty plant. "Century" Apac is even used for ventilating ducts . . . making possible a saving of approximately six hundred and fifty tons of critical metal. Immense quantities of "Century" Apac have gone into wartime construction. Yet despite this, "CENTURY" APAC IS AVAILABLE TO YOU NOW . . . PROMPTLY AND WITHOUT RESTRICTION.

"Century" Apac is the *modern* Asbestos-Cement structural sheet . . . fireproof, weatherproof . . . easy to handle, cut and fasten with nails or screws. Moderate in cost, it requires practically no maintenance. Whether you're planning for factory or home—either renovations or new building—you'll plan for permanence when you include K&M "Century" Apac for sheathing inside and out.

● For further information on the handling and application of K&M "Century" Apac, write us now.

FEATURES OF "Century" APAC

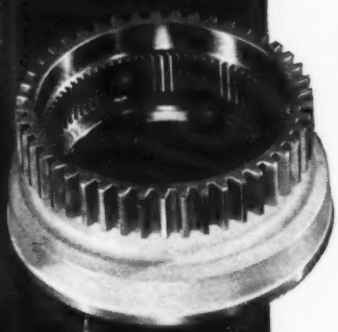
1. Made of Asbestos Fibre and Portland Cement
2. Pleasing light gray color
3. Fire resistant and durable
4. Convenient size—4' x 8', 4' x 9' and 4' x 10'
5. Low cost
6. Rat and termite proof
7. Easy to cut, handle and apply
8. Fastens with nails or screws
9. Practically no maintenance required
10. Prompt delivery

Our Ambler plants proudly fly the Army-Navy "E" flag with its star—an honor awarded K&M employees "for continued outstanding production of war materials."

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

CONTROLLING THE POWER OF 2,000 HORSES



TODAY'S aircraft engines are miracles of concentrated power. In the tapered nose of a fighting plane, the might of more than 2,000 horses is held in leash—ready at a touch of the throttle to carry the war to the enemy.

As engine horsepower has gone up—and up—and up, engine manufacturers have demanded gears of greater compactness and greater precision to carry these vastly increased loads.

Producing gears of sufficient accuracy to meet the demand of these super-engines was formerly possible by slow and tedious hand methods. But the problems presented in adapting these hand procedures to the manufacture of gears in quantities sufficient to power the world's greatest air force meant a new approach to gear production.

The thousands of Pratt and Whitney engines in use in every theater of the war testify to the successful solution of these problems. For today, in the plants of Foote Bros. Gear and Machine Corporation, revolutionary methods of gear fabrication, heat treatment and quality control are assuring our air forces of high precision gears—in quantities.

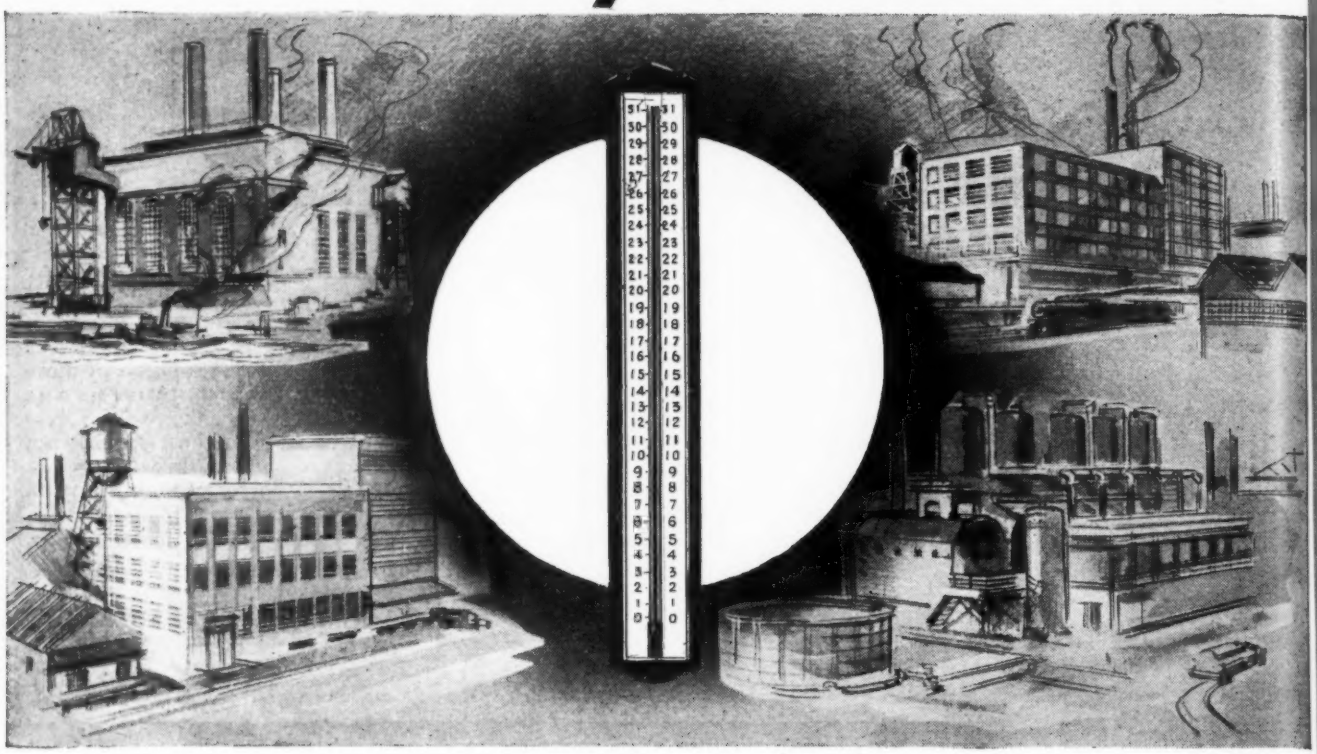
Translated into terms of peacetime production, these gears promise American manufacturers new economies in power transmission—new compactness in machine design.

FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 SO. WESTERN BLVD., CHICAGO 9, ILL.

FOOTE BROS.

Better Power Transmission Through Better Gears

Harnessing A VACUUM



VACUUMS, or low absolute pressures, play a vital role in the operation of steam-driven prime movers and in many refinery, chemical, drug, food and industrial processes.

Properly harnessed and controlled, vacuums aid in performing many services, such as: lowering boiling points; increasing prime-mover efficiencies; dehydrating and hydrating; refining of petroleum and other products; impregnating dyes, preservatives and other fluids; cooling and refrigerating, etc.

Ingersoll-Rand is one of the few manufacturers that builds a complete line of vacuum-producing equipment including: steam-jet ejectors, surface condensers, barometric condensers, and reciprocating dry-vacuum pumps, together with vacuum-refrigeration units. There is also a complete line of centrifugal pumps for circulating water and other liquids in connection with the vacuum equipment.

Our engineers have had years of experience in applying this vacuum-producing equipment to a wide range of work. They will be glad to consult with you on your vacuum processes.

Ingersoll-Rand

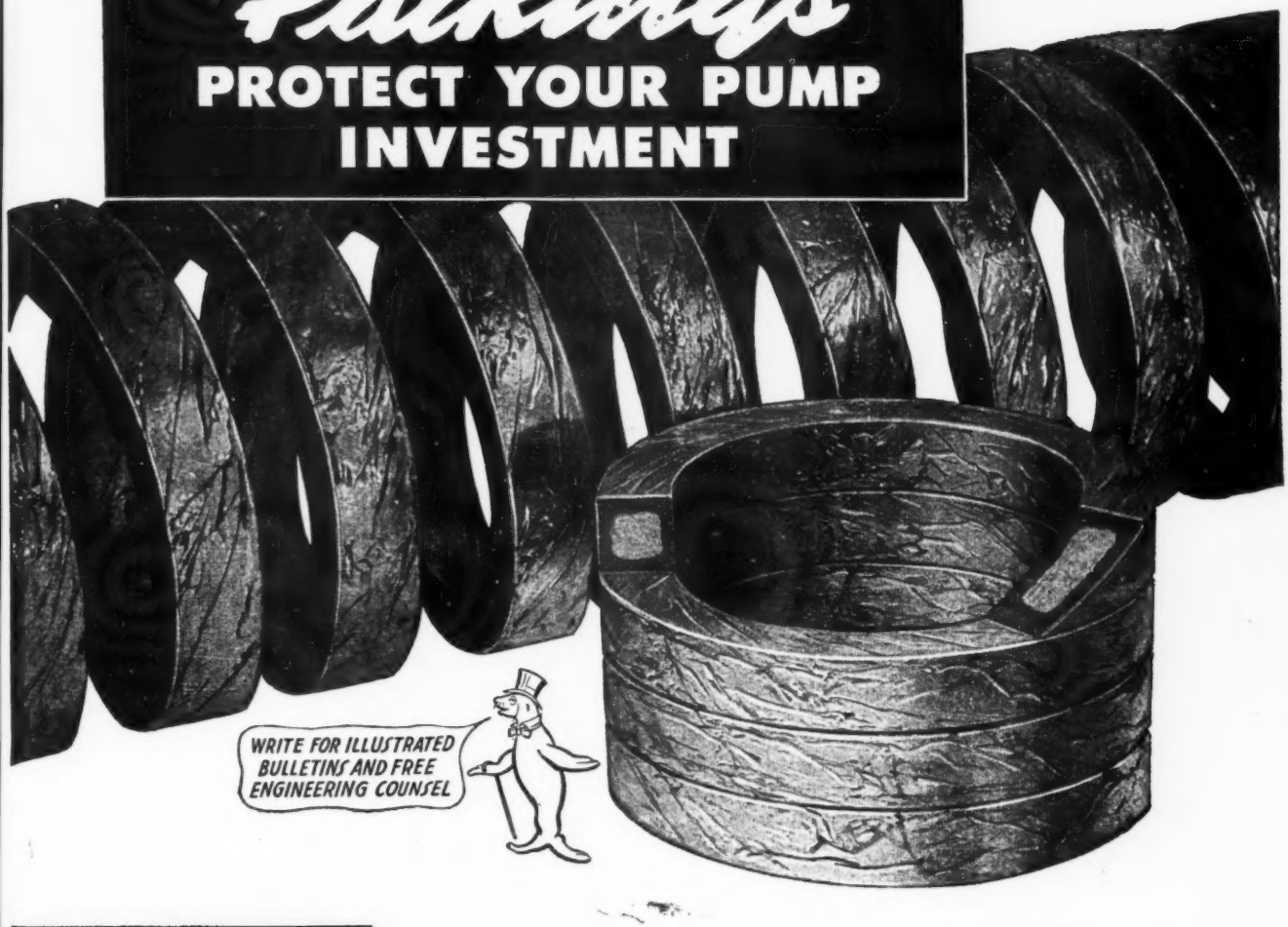
11 BROADWAY, NEW YORK 4, N. Y.

4-488

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

DURAMETALLIC *Packings*

PROTECT YOUR PUMP INVESTMENT



DURAMETALLIC "*Twist*"....

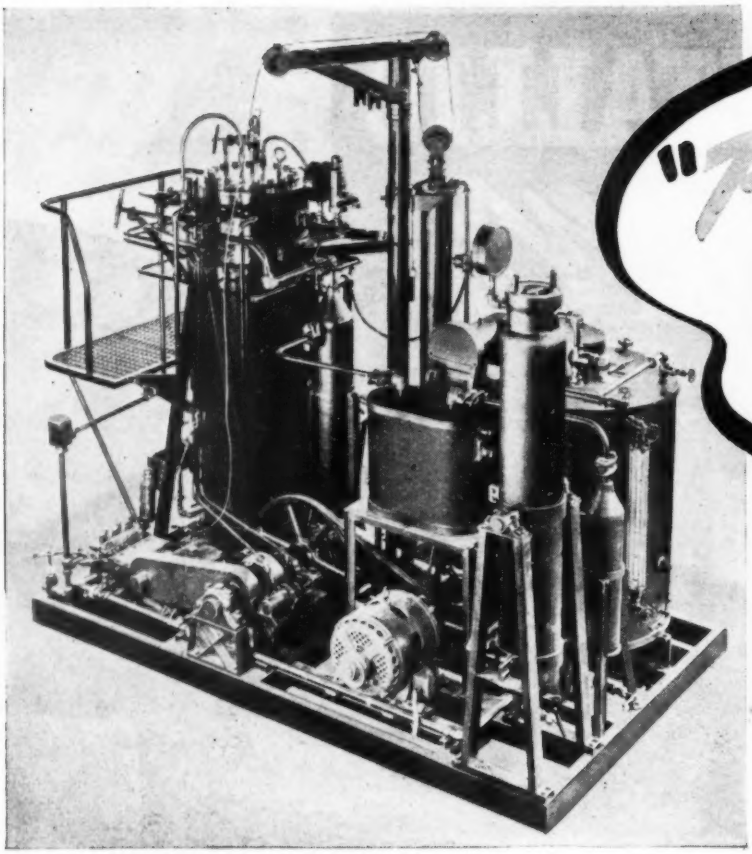
L-o-n-g uninterrupted runs are assured when you specify DURAMETALLIC—the original twisted, flexible, lubricated metallic packing. 1 It is processed to retain lubrication. 2 It distributes frictional load over several diagonally wrapped metal foil sheets. 3 It provides readier response to gland pressure. 4 It is especially designed to meet your specific need.

The PERFECT SEAL

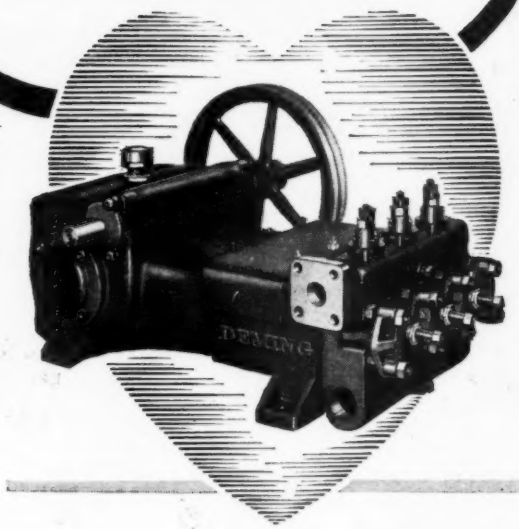
DURAMETALLIC CORPORATION

KALAMAZOO MICHIGAN

CHICAGO • DALLAS • DETROIT • FREDERICKSBURG, VA. • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MONTREAL
NEWARK • NEW ORLEANS • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • TULSA • YOUNGSTOWN, O.



"Pumps are HEARTS"



★ Pictured above is a stationary type of high pressure hydrogen generator. Mobile types of hydrogen and also oxygen generators are produced for the Armed Forces by the Independent Engineering Company of O'Fallon, Ill. The stationary types of units are produced by "Independent" for commercial use.

In such vital equipment, *"Pumps are HEARTS"* as the unfailing performance of the entire mechanism is dependent upon the unfailing performance of the pumps.

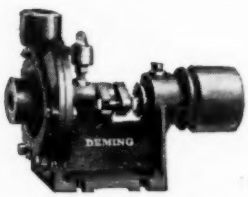
On each stationary type of hydrogen generator, "Independent" uses one Deming Figure 2993 "Oil-Rite" Horizontal Triplex Pump. On each Mobile type of hydrogen generator, two Deming Figure 2993 pumps are used.

On each stationary type of oxygen generator, one Deming Figure 4022 and one Figure 3900 Side Suction Centrifugal Pumps are used, excepting in the commercial units where additional cooling requires two of each of those pumps.

Throughout industry, Deming Pumps are employed as vital units in an almost limitless variety of applications. The extensive Deming line permits wide selectivity for types, sizes, and capacities of pumps.

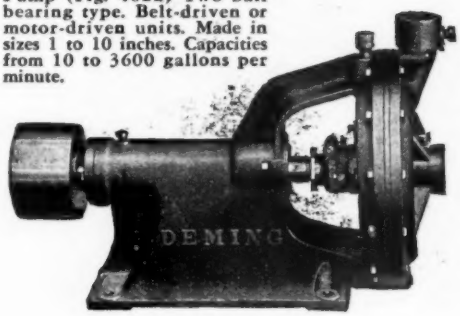
A nation-wide network of Deming Distributors provides local cooperation everywhere.

(above) Deming *"Oil-Rite"* Single-Acting Horizontal Triplex Pump (Figure 2993) Automatically oiled.



(left) Deming Side Suction Centrifugal Pump (Fig. 3900) Single ball bearing type. Belt-driven or motor-driven units. Wide range of sizes and capacities.

(below) Deming Side Suction Centrifugal Pump (Fig. 4022) Two ball bearing type. Belt-driven or motor-driven units. Made in sizes 1 to 10 inches. Capacities from 10 to 3600 gallons per minute.



DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company • Salem, Ohio

Cooling Tower DOs and DON'Ts
by MARLEY

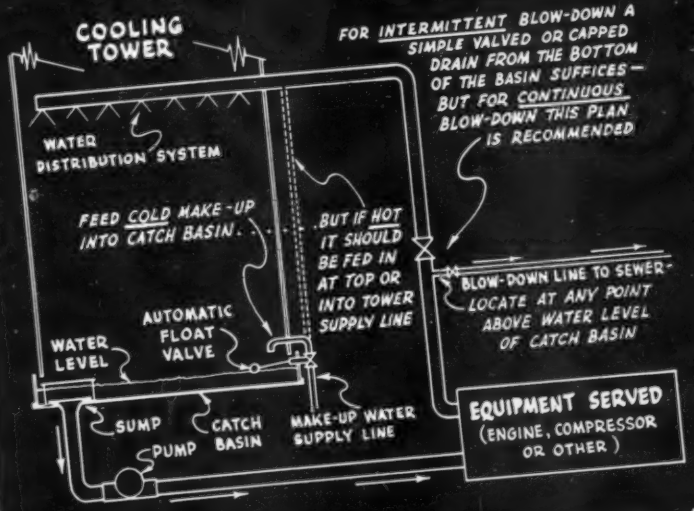
(No. 4 of a series)

"MAKE-UP" AND WATER TREATMENT

The amount of "make-up" water required by a cooling tower is determined by the total of "evaporation loss", "drift loss" and "blow-down".

Evaporation loss seldom exceeds 1% of the amount of water circulated for each 10° F the water is cooled. Drift loss is that water carried out of the tower as fine droplets entrained in out-going air, usually less than 0.2% in mechanical draft towers having efficient drift eliminators but from natural draft deck towers and spray towers drift may lose as much as 1% to 3% of the water circulated. Blow-down is the continuous or intermittent removal of a part of the tower's circulating water to properly control concentration of chemicals in the water.

- If warm water is used as make-up, introduce it at top of tower; if cool, into catch basin.
- When planning make-up and water-treating facilities, make certain of adequacy at peak load.


COOLING TOWER
WATER DISTRIBUTION SYSTEM
FEED COLD MAKE-UP INTO CATCH BASIN
BUT IF HOT IT SHOULD BE FED IN AT TOP OR INTO TOWER SUPPLY LINE
FOR INTERMITTENT BLOW-DOWN A SIMPLE VALVED OR CAPPED DRAIN FROM THE BOTTOM OF THE BASIN SUFFICES — BUT FOR CONTINUOUS BLOW-DOWN THIS PLAN IS RECOMMENDED
BLOW-DOWN LINE TO SEWER — LOCATE AT ANY POINT ABOVE WATER LEVEL OF CATCH BASIN
WATER LEVEL
AUTOMATIC FLOAT VALVE
SUMP PUMP
CATCH BASIN
MAKE-UP WATER SUPPLY LINE
EQUIPMENT SERVED (ENGINE, COMPRESSOR OR OTHER)

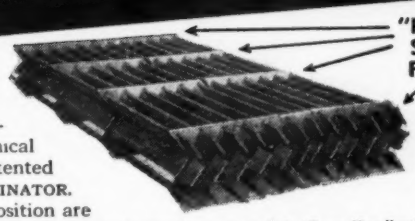
For any of the following conditions, consult a reliable water treatment engineer:

SCALE—In practically all water some scale-forming materials are found. Although sometimes troublesome in cooling towers, their greatest menace is to the equipment served, where scale deposits restrict water passages and reduce the heat transfer rate. Scale is controlled by "softening" or otherwise treating the water.

SOLUBLE SOLIDS—Concentration of soluble solids in cooling tower circulating water will raise the effective wet bulb temperature, thereby raising the temperature of the water leaving the tower. It may also cause sludge deposit in the system and corrosion of metals. Proper blow-down is a simple, effective control.

- Severe corrosion of steel towers or parts may be due to acid condition of the circulating water.

ALGAE—Uncontrolled organic matter, such as algae, can clog piping and spray nozzles, prevent proper water distribution and uniform fall through the filling, restrict suction through the sump, and collect in the equipment served until water flow and heat transfer are stagnated. Any of several common and inexpensive algaecides are effective against this nuisance.



DO YOU KNOW— that Marley pioneered and perfected the elimination of "drift" from mechanical draft towers with this patented triple-effect DRIFT ELIMINATOR. Frames of "Presite" composition are slotted to hold the Redwood blades into easily-removable "bundles," without rigid fastenings of any kind. Blades are kept in precise alignment and spacing, yet are free to expand and contract without warping or stress . . . maximum moisture-stoppage with minimum resistance to air flow.

MARLEY COOLING TOWERS

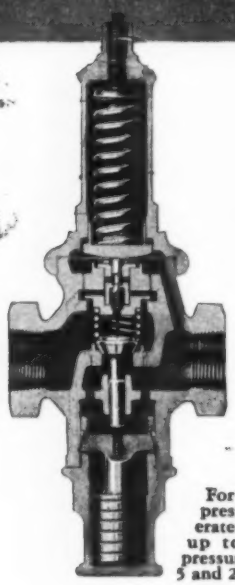
44-A

THE MARLEY COMPANY, INC. · KANSAS CITY · KANSAS

Masoneilan Regulators

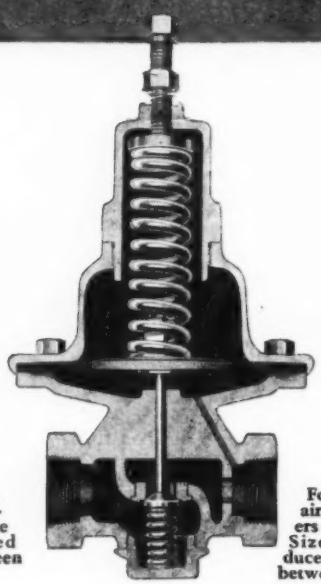
(For Steam, Water, Air)

HOLD PRESSURES WHERE YOU WANT THEM



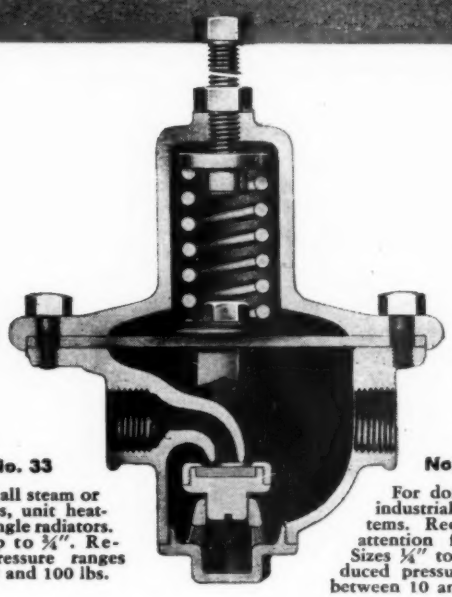
No. 11

For reducing steam pressures. Pilot operated. Sizes—bronze up to 2". Reduced pressure ranges between 5 and 225 lbs.



No. 33

For small steam or air lines, unit heaters or single radiators. Sizes up to ¾". Reduced pressure ranges between 2 and 100 lbs.



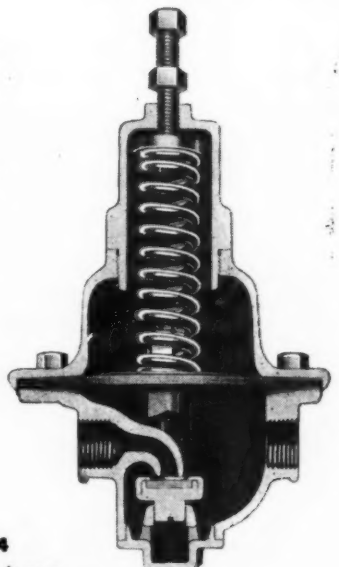
No. 227

For domestic or industrial water systems. Requires no attention for years. Sizes ¼" to 2". Reduced pressure ranges between 10 and 60 lbs.

In spite of fluctuating initial pressure or demand, Masoneilan reducing regulators hold pressures where you want them providing accurate, reliable and economical operation.

Their simplicity of operation and sturdy construction reduce waste, cut maintenance costs and assure long life under practically all types of operating conditions.

Some Masoneilan pressure regulators are now available for maintenance and replacements. We suggest you write for complete information and catalog 71.



No. 414

For reducing air pressure in industrial service. Also recommended for dead end service. Sizes ¼" to 2". Reduced pressure ranges between 10 and 60 lbs.

MASONEILAN STRAINERS

Prevent scale, dirt, chips, etc. from damaging regulators, traps, valves and pumps... use Masoneilan Strainers. These precision-made strainers keep out all foreign matter. They'll eliminate maintenance delays and save you money.

MASONEILAN

MASON-NEILAN REGULATOR CO.

1186 ADAMS ST., BOSTON 24, MASS.

New York · Philadelphia · Pittsburgh · Tulsa · Toledo · Chicago · Atlanta · St. Louis · San Francisco · Los Angeles · Houston

Mason Regulator Co. of Canada, Ltd., Montreal, Canada

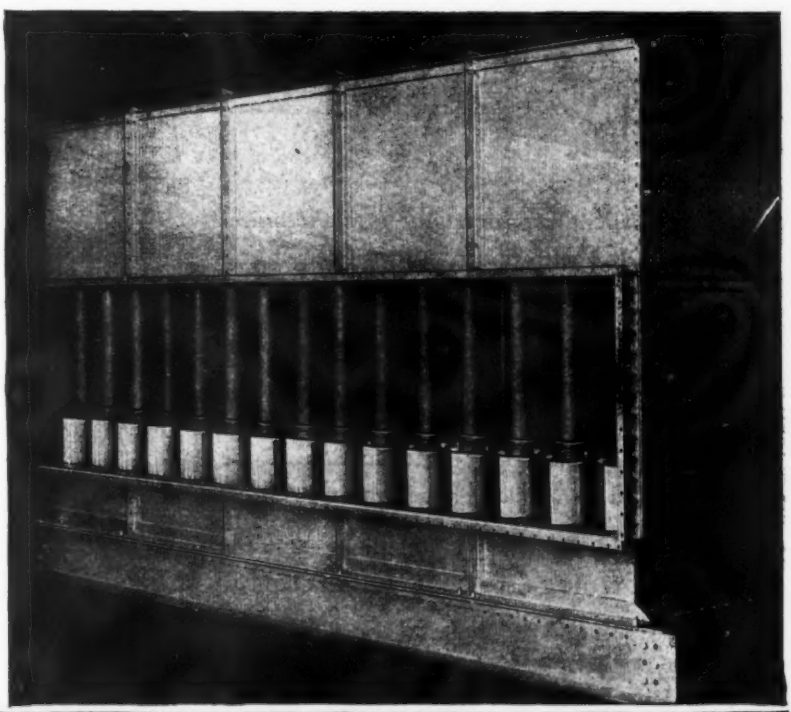
Dust Will be a curiosity some day!

Dust from power plants will become so unusual, as science progresses, that the existence of fly-ash in the atmosphere will be a rarity. Even now, hundreds of public utility and industrial plants are using Thermix Dust Collectors to collect from 99% to 100% of the pulverized fuel fly-ash that falls within a mile of the plant, to remove a high percentage of the less troublesome dust which travels five or more miles and, incidentally to save wear on their induced-draft fans.

Not enough black dust can escape a Thermix Dust Collector to be objectionable.

If space is limited, a Thermix Tubular Dust Collector can be fitted in the bell of an existing stack, at the outlet of an air heater, or in almost any available space.

For more than 20 years we have been solving every type of dust problem. Without obligation our engineers will suggest how you can eliminate contaminating the atmosphere with dust from your stack. Our Catalog No. 108 is yours for the asking.



PRAT-DANIEL CORPORATION

E. PORT CHESTER, CONN.

Thermix Engineering Co., Greenwich, Conn.

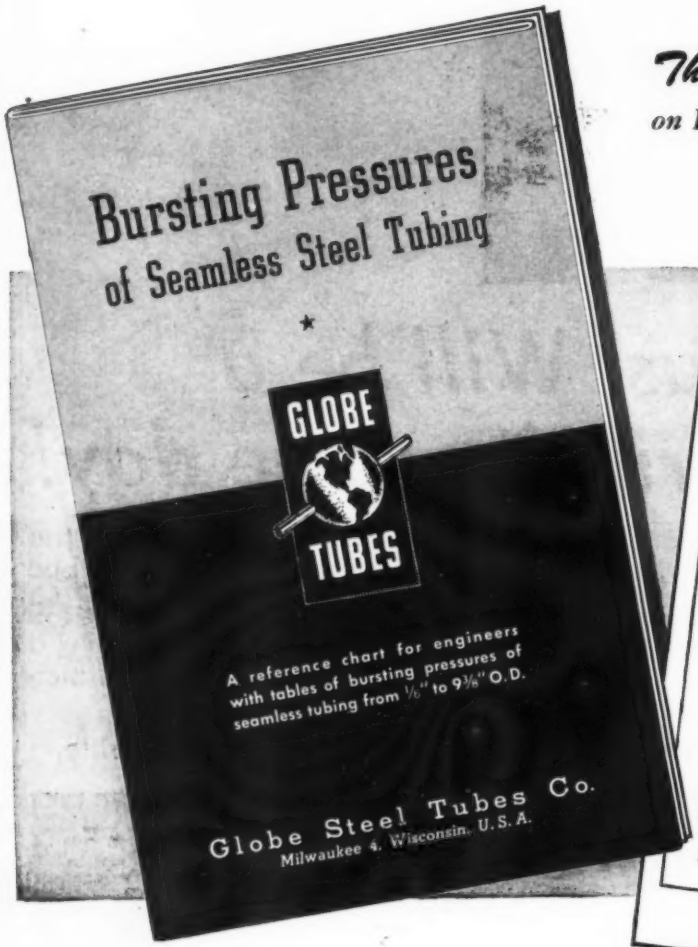
Project and Sales Engineers

Distributors in Principal Cities

Thermix *Tubular* Dust Collector

Of Interest to Engineers and other Technical Men

This Valuable Reference Bulletin
on Bursting pressures of Seamless Steel Tubing.


Bursting Pressures
of Seamless Steel Tubing
GLOBE
TUBES
A reference chart for engineers with tables of bursting pressures of seamless tubing from ⅛" to 9⅜" O.D.
Globe Steel Tubes Co.
Milwaukee 4, Wisconsin, U.S.A.

Bursting Pressure of Seamless Tubing as Determined by Barlow's Formula for a Stress of 10,000 lbs. p.s.i.

Wall Thickness		Outside Diameter in Inches							
B. W. G.	Inches	⅛	5/32	3/16	7/32	¼	9/32	5/16	11/32
24	.022	3520	2816	2347	2011	1760	1564	1408	1280
23	.025	4000	3200	2667	2286	2000	1778	1600	1455
22	.028	4480	3584	2987	2560	2240	1991	1792	1629
21	.032	5120	4096	3413	2926	2560	2276	2048	1862
20	.035	5600	4480	3733	3200	2800	2489	2240	2036
19	.042	6720	5376	4480	3840	3360	2987	2688	2444
18	.049	....	....	5227	4480	3920	3484	3136	2851
17	.058	....	....	6187	5303	4640	4124	3712	3375
16	1/16	....	....	6667	5714	5000	4444	4000	3642
	.065	....	....	6933	5943	5200	4622	4160	3782
15	.072	....	....	....	....	5760	5120	4608	4189
14	.083	....	....	....	....	6640	5902	5312	4829
13	3/32	....	....	....	....	7500	6667	6000	5455
12	.095	....	....	....	....	7600	6756	6080	5527
	.109	....	....	....	....	....	....	6976	6342
11	.120	....	....	....	....	....	....	7680	6982

Here is excellent data for engineers and technical men who deal with boiler, still, condenser and heat exchanger tubing and other pressure tubing.

The 24-page booklet contains 16 pages of calculations on tubes in sizes from ⅛" to 9⅜", outside diameters, and wall thicknesses from 24-gauge to 1½", and a full explanation of the method used in calculating the pressures.

A copy of this informative bulletin is yours for the asking. Write for copy of Bulletin 112 today.

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

GLOBE TUBES

★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL
Tubes

5013

GLOBE STEEL TUBES CO., *Milwaukee 4, Wis., U.S.A.*

7 YEARS ACTUAL PLANT USE

HAS DEMONSTRATED CORAVOL'S ABILITY TO PROTECT STEAM AND CONDENSATE LINES AGAINST CORROSION--ELIMINATE REPLACEMENTS AND SHUTDOWNS--SAVE LABOR --INCREASE HEATING EFFICIENCY

LINES CORAVOL BOILER

Originated and developed by

WESTERN CHEMICAL COMPANY,

CORAVOL Brings You a Revolutionary Method for Preservation of Steam and Condensate Lines

For 7 years, in hundreds of heating and steam power plants in more than 20 industries, Coravol has successfully prevented corrosive action in steam and condensate return lines.

WHAT DOES THIS MEAN TO YOU? It means—(1) freedom from production and service loss due to shutdowns; (2) elimination of replacements, with the resulting saving of lost time, and labor and material costs; (3) clean lines, valves, traps, tanks and radiators without maintenance labor; (4) increased efficiency of heat transfer surfaces.

WHAT CORAVOL IS. It is a volatile and condensible liquid treatment for steam systems. Only CORAVOL (and those products licensed under Western Chemical Company's basic patent) completely follows the steam-condensate circuit for the prevention of corrosion thruout the entire system.

HOW CORAVOL WORKS. When fed to the steam system, Coravol *volatilizes* with the steam, *condenses* with the steam, and dissolves in the condensate. Coravol neutralizes and absorbs carbon dioxide which is the cause of acid and corrosive steam and condensate, thereby maintaining the alkaline condition in which corrosion is least active. Coravol does *not* remain in any one zone, but circulates thruout and protects all zones against attack.

WHAT CORAVOL ACHIEVES. The action of Coravol is two-fold. In addition to protecting against corrosion, Coravol cleans out old rust and accumulated deposits resulting from previous corrosion. This cleaning action increases the efficiency of heat transfer surfaces, restores original capacity of lines, and the operating efficiency of valves and traps.

INDIVIDUAL SURVEY. A survey of your individual operating conditions will determine *your* particular needs. At no cost or obligation to you, recommendations are then submitted for your consideration.

EASY and ECONOMICAL to Use. Start enjoying the time, trouble, and worry-saving benefits of Coravol. Write *today* for complete information about the Coravol Process. You'll be glad you did.

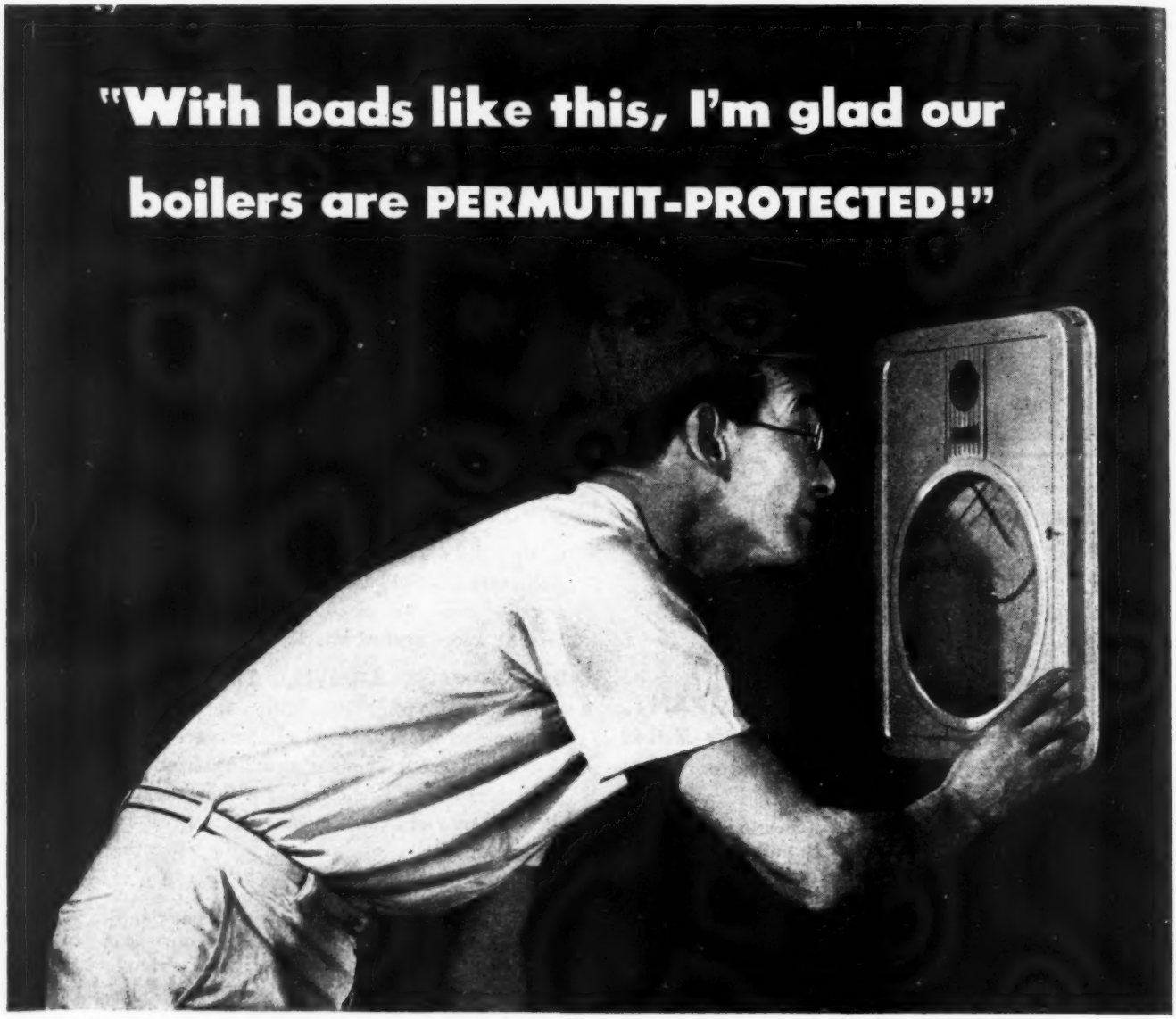
The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile amines purchased from other sources may be used in steam systems upon payment to Western Chemical Co. of the same royalty per pound as is included in the price of CORAVOL.

WESTERN CHEMICAL CO.

715 WASHINGTON STREET
KANSAS CITY 6, MISSOURI

54 Years of Pioneering in the Chemical Treatment of Water

"With loads like this, I'm glad our boilers are PERMUTIT-PROTECTED!"



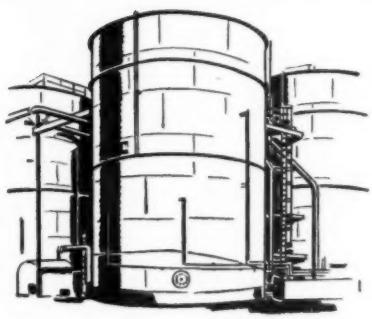
Good water prevents scale and corrosion

War strain increases the threat of trouble from impurities in feedwater. But not at Permutit-equipped plants. Permutit* removes the impurities, gives the water the exact quality needed to do its job efficiently. Thousands of war plants and Army and Navy establishments enjoy this control.

Permutit Water Conditioning equipment covers every type, including Hot and Cold Lime Soda Softeners, Zeo-Karb* Water Conditioners, Spaulding Precipitators, Deaerating Heaters, Degasifiers, Silica Removal, Continuous Blowoff and the new Demineralizing process to produce a low-cost substitute for evaporated water.

Let Permutit help keep the wheels turning at *your* plant. Just drop a line to The Permutit Company, Dept. A 330 W. 42nd St., New York 18, N. Y., or to Permutit Co. of Canada, Ltd., Montreal.

*Trademarks Reg. U. S. Pat. Off.



PERMUTIT SILICA REMOVAL PROCESS

Silica content is reduced to any degree desired, scale and deposits are eliminated. Reagents are low in cost, do not add soluble by-products.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

Serving industry and the armed forces...with GOOD WATER

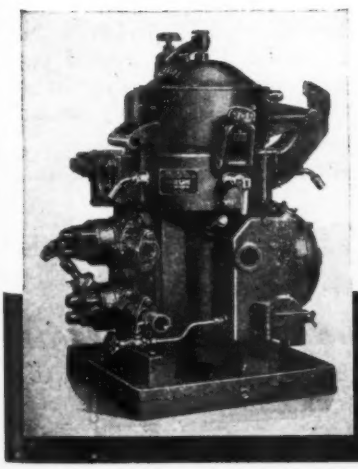
NEED DE LAVAL-PURIFIED OIL

LITTLE or no thought need be paid to lubrication of the picturesque old windmill but today's turbines and engines require that the lubricant be kept in practically "new oil" condition all the time. The surest way to keep oil in this condition is to by-pass a portion of it continuously through a De Laval Oil Purifier.

De Laval centrifugals remove instantaneously the impurities normally collected in service — water, sludge, carbon or dirt. The design of the De Laval bowl enables these foreign materials to be most completely centrifuged out of the oil, leaving the lubricant so thoroughly purified that its effectiveness remains unimpaired for indefinitely long periods.

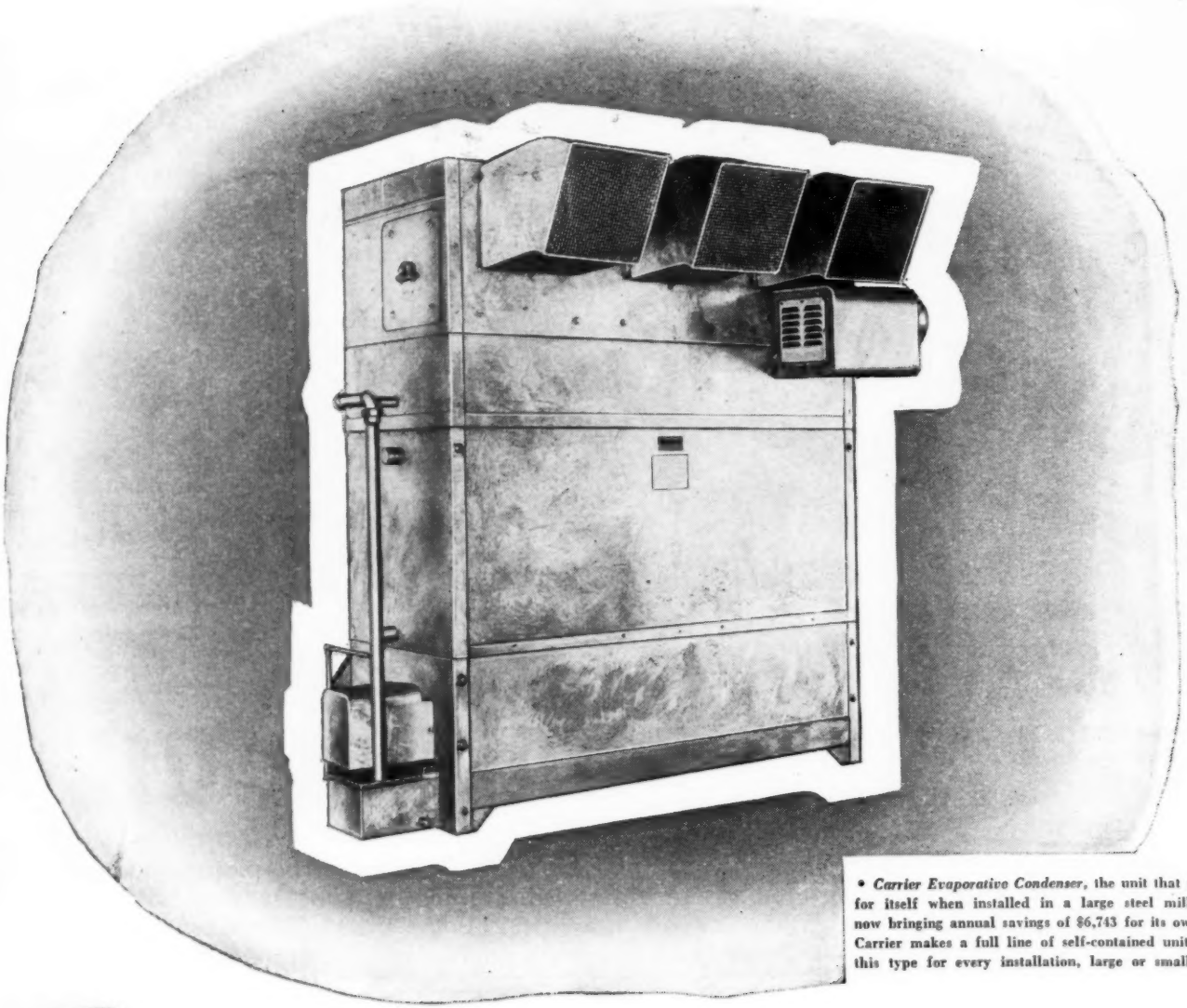
There are De Laval Oil Purifiers for power plants of every size and all assure the same high degree of protection to bearings and to other vital moving parts.

Additional details will gladly be sent upon request.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 — 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS



• *Carrier Evaporative Condenser*, the unit that paid for itself when installed in a large steel mill, is now bringing annual savings of $6,743 for its owner. Carrier makes a full line of self-contained units of this type for every installation, large or small.

Saves $6,743 a year

ON THE COST OF WATER FOR COOLING OVEN

A SENSATIONAL example of the savings that are sometimes possible by adopting Carrier Evaporative Cooling to supply water for industrial cooling processes is reported by the engineers of a large steel mill.

The water cooling was used for an annealing furnace. Cost of water, before installation of a Carrier Evaporative Cooler was $1.13 an hour . . . 24 hours a day, 300 days a year . . . $8,136 annually, water cost. Consumption was 175 GPM. With the new unit, water consumption was cut to 5 GPM . . . water, electrical upkeep, repair parts totaled only 11.7¢ per hour . . . annual cost was cut to $1.392.40. Saving was enough to pay for the Evaporative Cooler and its installation, with total savings of $6,743 a year.

Your water supply problem may be different. Outside supply may be undependable; subject to seasonal cut-offs if reservoirs in your municipality sink to dangerous levels. Or supply mains may be inadequate for the water you need . . . or you may lack satisfactory disposal facilities. Whatever your problems, be assured that Carrier, with 41 years experience in solving industrial cooling problems, can offer practical help. Consult Carrier now if your need is immediate and your production is vital to the war industry, or if you are already making postwar plans.

CARRIER CORPORATION, Syracuse, New York

Carrier

ARMY E NAVY

AIR CONDITIONING • REFRIGERATION

INDUSTRIAL HEATING

FACTS YOU MAY NOT KNOW ABOUT EAGLE MINERAL WOOL INSULATION

Practical test* proves EAGLE Super "66" Insulation is non-corrosive—in fact, it is actually rust-inhibitive

Springy Ball Structure

Eagle High Temperature Mineral Wool is nodulated into pellets, or "springy balls," each of which contains thousands of tiny dead air cells which impart high thermal resistance. Pellets keep their dead air cell structure after application. Eagle Super "66" Plastic Insulation forms an efficient monolithic coating without cracks or joints . . . is designed to serve up to 1800° F. . . . is reclaimable and reusable when not subjected to temperatures exceeding 1200° F.

With Super "66" we recommend Eagle INSULSEAL, a fire-resistant, protective coating that safeguards insulation from damage.

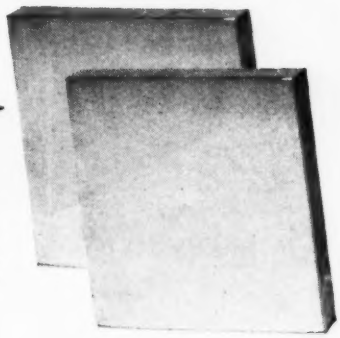
FREE *Manual!*

Shows how insulation on a single Boiler Shell can save you as much as $1,500 a year in fuel costs.

Write for your copy of this timely booklet on how *you* can conserve industrial heat and power with mineral wool insulation.

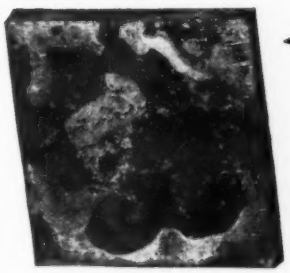
* **AS THEY WERE**

Here's a photograph of two steel blocks before being used to test the anti-rust properties of Eagle Super "66" in the Eagle-Picher laboratory. Note unblemished surfaces. Then study accompanying photos.



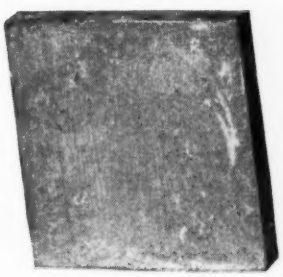
AS ONE BECAME

How one of the steel blocks looked after being imbedded in a regular insulating cement for the test period. Note the extent of the rust. Such corrosion also occurs on iron and steel equipment whether heated or cold.



AS ONE REMAINED

Imbedded in Eagle Super "66" for the same test period, this block shows how effectively the rust-inhibitive and non-corrosive properties of Eagle Super "66" protect your heated equipment.



The above test will readily suggest to you the *protection* Eagle Super "66" Plastic Insulation can give your costly and perhaps irreplaceable heated equipment—quite apart from the sweeping savings on fuel which it affords!

EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio

This battery is designed specifically for Diesel cranking

When you select an Exide Battery for a Diesel cranking job, you have the same assurance of complete satisfaction under all conditions as you have in the engine itself. For the developments and refinements that have been made in high speed Diesel engines have been matched, step-by-step, by Exide Engineers.

An Exide Battery, designed for a specific cranking job, is your assurance of long life, complete dependability and extreme ease of maintenance, a saving in vital man hours.

Write for a FREE copy of the Exide catalogue on Heavy-Duty Batteries. It gives you data on how to order, and how to get the most from your Exide Heavy-Duty Batteries for cranking Diesel engines.

ARMY E NAVY

Exide

BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

A DESIGNER'S DREAM: FLORI-FABRICATION

This welded Manifold—an example of Flori-Fabrication—provides multiple gas passages within a water-cooled jacket by use of welded *Helical* baffles, and is used in conjunction with turbo chargers.

Permissible tolerances for welded construction: Not fractions of an inch . . . but *thousandths* . . . between nozzled outlets and overall lengths. Tough? Yes! but not when construction-design is engineered by Flori.

If it's fabrication—contact Flori!

FLORI PIPING

THE FLORI PIPE COMPANY • ST. LOUIS—CHICAGO

TYPICAL DIESEL LUBRICATION PROBLEMS:

3. Ring-Sticking

Ring-sticking usually results from deposits formed by the combination of the residues of oxidized lubrication oil and fuel with fuel soot.

In four separate ways, RPM DELO prevents the formation of these deposits:

1. RPM DELO is manufactured from a carefully selected base oil containing natural inhibitors highly resistant to oxygen. It contains no heavy residues which may be left behind to act as a binder for the fuel soot.

2. RPM DELO contains an added oxidation inhibitor which greatly reduces the rate at which the oil absorbs oxygen.

3. RPM DELO has chemical detergent properties. The compounding material reacts with the oxyacids to render them essentially inert so that they are no longer able to polymerize to form gums and lacquers.

4. RPM DELO has peptizing properties which enable it to maintain soot and oxidation products in suspension in minute particles. This prevents these materials from settling from the oil and forming engine deposits.

RPM DELO, moreover, is non-corrosive to all types of bearings, does not foam and has very high metal adhesion qualities at both high and low temperatures.

RPM DELO is marketed throughout the United States and many foreign countries under the following names: RPM DELO, Caltex RPM DELO, Kyso RPM DELO, Signal RPM DELO, Sohio RPM DELO, and Imperial-RPM DELO (concentrate).

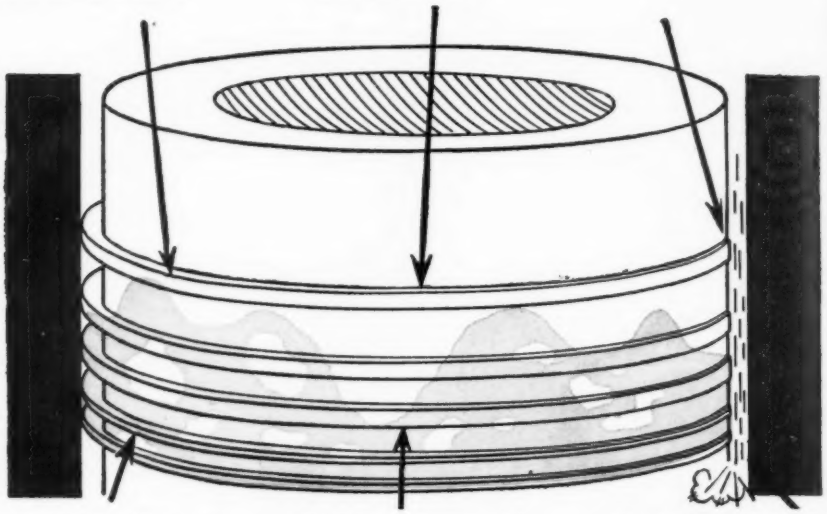
☆ ☆ ☆

HOW RING-STICKING OCCURS

Decomposition products of fuel and lubricating oil deposit in ring groove, behind ring and in side-clearance space.

Rings stick in grooves, no longer expanding to form tight seal between piston and cylinder wall.

With seal broken, hot, high pressure gases "blow-by" stuck ring.



Escape of gases reduces compression, overheats piston, increases oil deterioration.

Blow-by pressure removes lubricating oil from rings and cylinder, leaving dry spots.

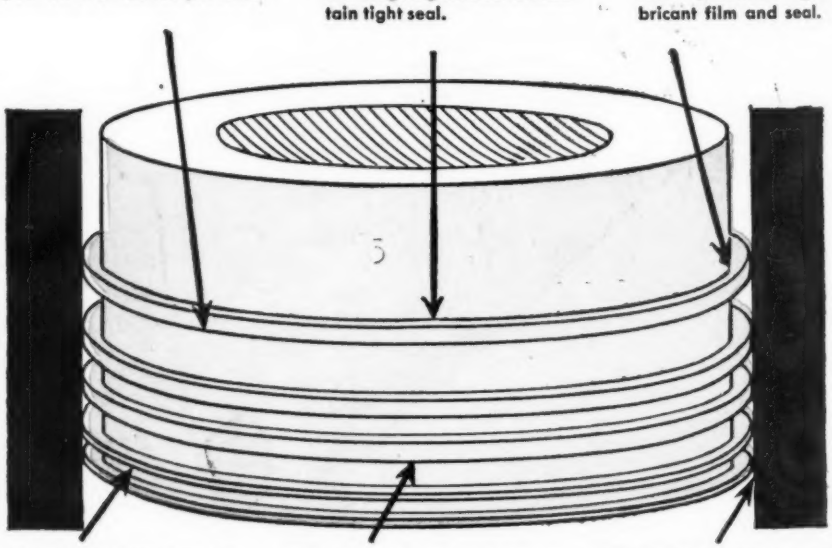
Lack of lubrication results in high ring and liner wear and scratching.

HOW RPM DELO PREVENTS RING-STICKING

Detergent in RPM DELO prevents deposition of oxidation products.

Ring grooves are kept clear, allowing ring tension to maintain tight seal.

RPM DELO clings to ring surface, maintaining lubricant film and seal.



Tight seal eliminates blow-by, maintaining compression and power.

RPM DELO adheres to hot surfaces, protecting entire surface of rings, piston and liner.

RPM DELO lubrication results in minimum ring and liner wear, eliminates scratching.

RPM DELO

STANDARD OF CALIFORNIA

BALANCED

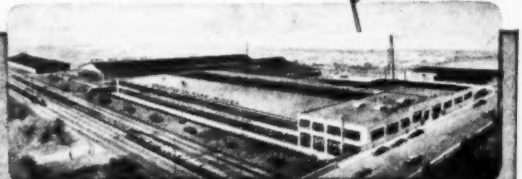
Philadelphia
HERRINGBONE
Speed Reducers

Indicative of the well planned design features of Philadelphia Herringbone Reducers is the gear arrangment in the Double and Triple types. In these, the gears are located symmetrically with respect to the centerline of the housing rather than the offset arrangement. Two standard bearings are provided on each shaft with each bearing absorbing an equal load. Offset arrangements of herringbone gears would result in unequal bearing loads, while a similar arrangement of single helical gears imposes an additional load by the thrust action.

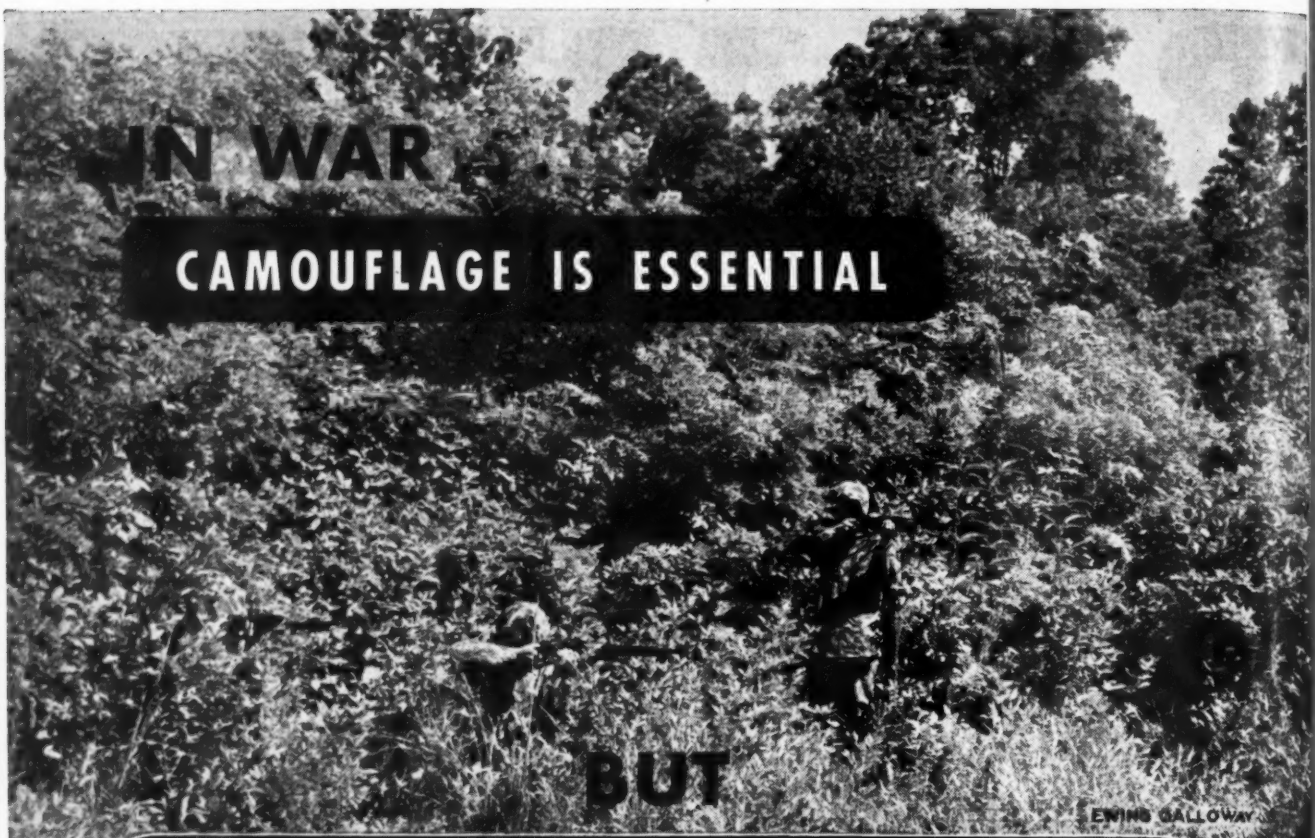
It is evident then that Philadelphia Herringbone Reducers with double helical gears spaced equidistant from the bearings in the first and intermediate reductions, with a continuous tooth herringbone gear set on the centerline for final reduction provides perfect balance and symmetry.

For complete construction details get our Catalog H-39. Please write on your business letterhead.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls



IN INDUSTRIAL WATER CONDITIONING

it has no place

BIRD-ARCHER

promises only what can actually be accomplished

COMPLETE MODERN and SCIENTIFIC

WATER CONDITIONING SERVICE

FOR STEAM OR PROCESS REQUIREMENTS

Consultation Without Obligation

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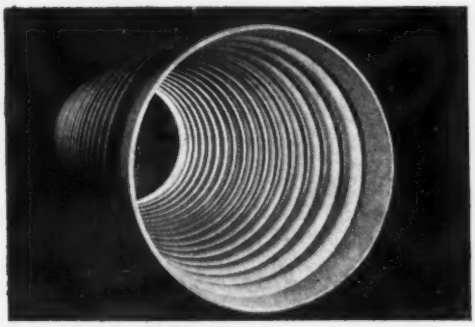
THE BIRD-ARCHER CO.

NEW YORK 17, N. Y. • CHICAGO 11, ILL. • PHILADELPHIA 40, PA. • MONTREAL, CAN.

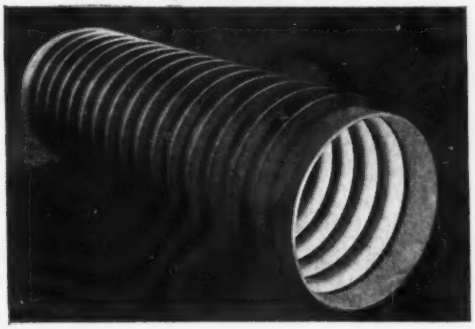
SURVEYS • PLANT STUDIES • CONSULTATIONS • TREATMENTS
PLANT DESIGN • SUPERVISORY SERVICE • LABORATORY SERVICE

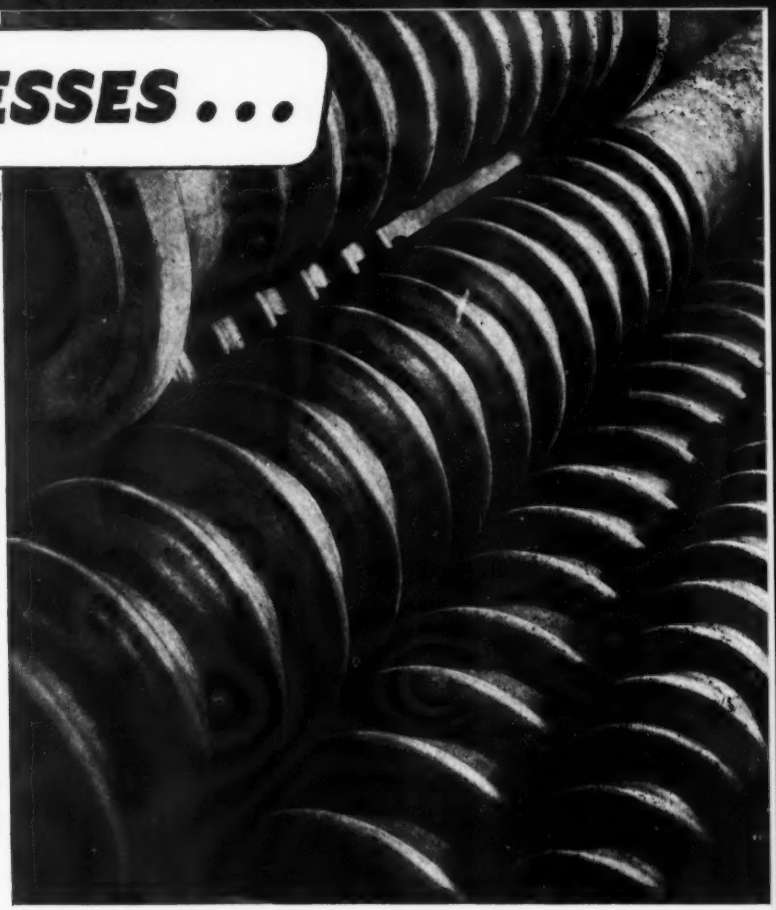
RELIEVE STRESSES . . .



Note Uniformity of Corrugations

24" O. D. by 3/8" Wall





Reduce End Reactions with Pittsburgh Piping and Equipment Company CORRUGATED TANGENTS

PITTSBURGH Piping and Equipment Company Corrugated Tangents are at least 5 times as flexible as a piece of straight pipe of the same length, diameter and wall thickness.

The shape of each individual corrugation with proper spacing is carefully worked out on the correct basis for best operating results. This design is faithfully reproduced with the exacting uniformity necessary to provide even distribution of stresses.

The unusual flexibility of this type of fabricated piping makes possible the use of shorter lines without excessive stresses, strains and end reactions against equipment. It also allows for more convenient location of valves and assures more compact and efficient systems.

Our engineering department will be glad to show you how and where this type of fabrication can be used to your advantage when planning replacements, additions, improvements, or complete new piping systems.

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

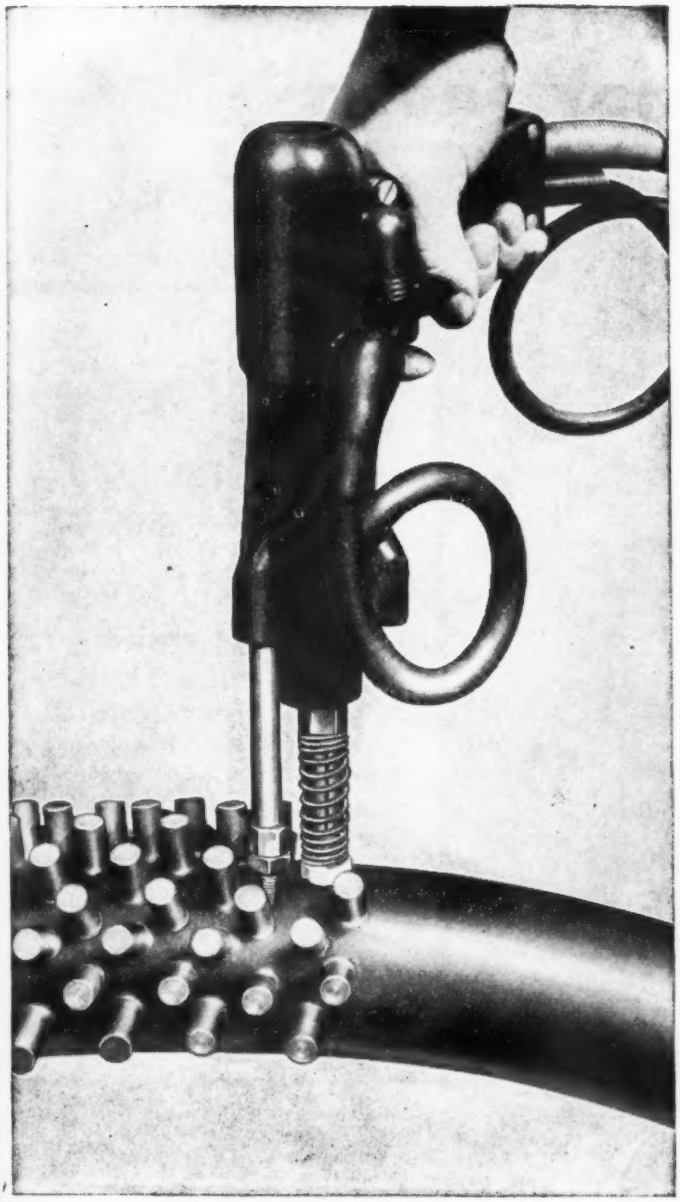
Woolworth Building, New York
Occidental Building, Indianapolis
Book Tower, Detroit
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
525 Market Street, San Francisco

THE name Sivyer has long meant quality steel castings—castings meeting *and exceeding* all the requirements for high pressure, high temperature service . . . for long-time service.

Behind these castings stands Sivyer's third of a century experience—assuring close dimensional accuracy, trueness to pattern contour and shape and integrity of metal. It is these all-important qualities that have established the Sivyer trademark as worth looking for when longer casting life is wanted. Make Sivyer *your* source for all steel castings.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY



How to repair burned-out boiler tubes!

The Nelson Stud Welder will make your boiler maintenance and repair easy. Why keep a large inventory of studded pipe on hand? Or, why keep your boiler out of operation for a long period when you can repair it at your own plant?

The photographs illustrate the ease of application and the consistent welds achieved. One operator and a helper can average about 2300 studs or about 24 feet of tube, in eight hours.

The Nelson Stud Welder is *completely portable* and light in weight. Proven by five years of actual use and employed by more than 300 industrial plants, it can be used for repair and maintenance wherever there is need to end-weld studs to metal.

Write today for complete details and catalog. Find out exactly how you will save up to 75% of your time and material cost. Write to:

NELSON SPECIALTY
WELDING EQUIPMENT CORP.

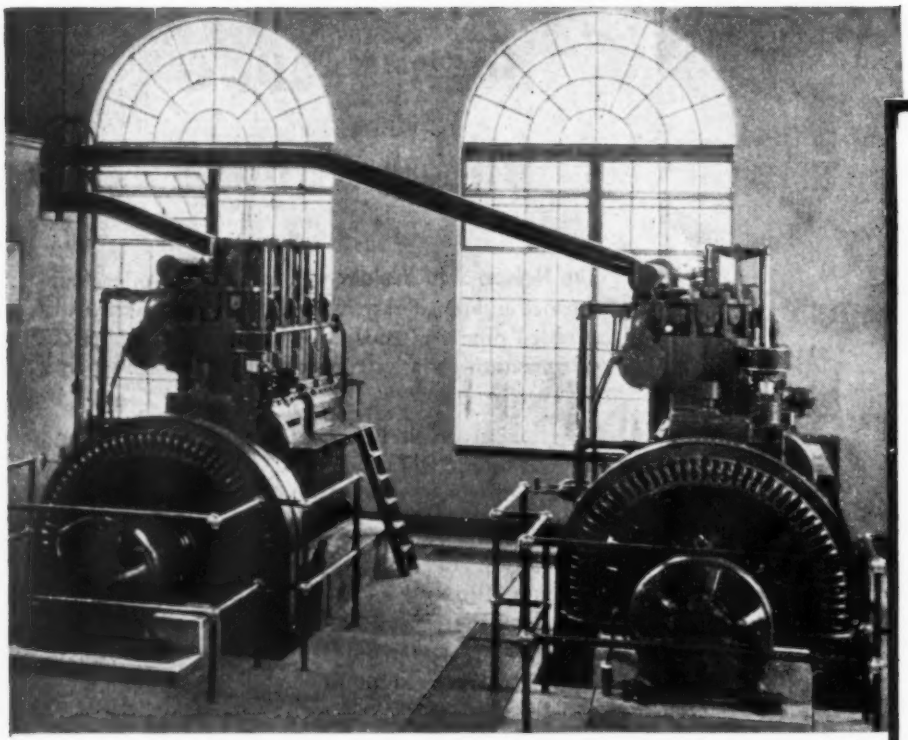
Dept. P-8, 440 Peralta Avenue, San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 South Sixth St., Camden, N. J.

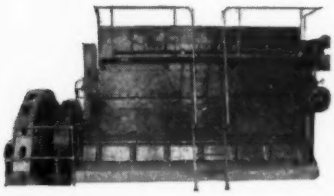
Studs are welded 1¼" apart on 19° centers. Nelson studs are manufactured in numerous diameters and lengths. The studs are simply placed in the chuck of the gun, a ferrule placed on, and the trigger pulled. An arc is created which *automatically* welds the stud to the tube.

Complete fusion between the stud and tube results from automatic timing and complete shielding of the arc. The strength of the weld is equal to the strength of the stud. *No previous welding experience is necessary to operate the Nelson gun.*

A GREAT LITTLE CITY MAKES A TIDY PROFIT



Two 4-cycle, 300 hp.. mechanical injection, Worthington Diesels installed in Kenyon in 1932, and the latest addition, a 750 hp. Worthington unit which more than doubled plant capacity in 1941



10 YEARS—AND NEVER A STUCK RING!

Successful pressure lubricating system of Worthington Diesels contributes to low repair costs through the years. At Kenyon, each 300 hp. engine has run an average 5000 hours a year for 10 years, using the original valves, bearings and cylinder liners, and without a single breakdown or major repair.

Civic Improvements in Kenyon, Minnesota, Result from 10 Years of Progress With Worthington Diesels

Kenyon, one of the best lighted, progressive little cities in Minnesota made $146,757.28 net profit between 1932 and 1941 on its Diesel-powered municipal plant – thus paying for the entire investment in Worthington Diesels with a comfortable margin for other civic projects.

Worthington, your partner in power progress, both for economical power and for wider distribution of power-using equipment, invites you to consider these *typical* figures as an indication of what you also can accomplish with Worthington Diesels.

Write for "Ten Diesel Years at Kenyon, Minnesota," an article reprinted from a leading Diesel power publication. Worthington Pump and Machinery Corporation, Buffalo Diesel Engine Division, Buffalo, N. Y. District offices in principal cities.

Power Progress in Kenyon, Minnesota

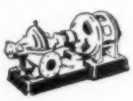
Average fuel return	11 kw. hrs. per gallon
Average annual engine repairs . . .	$175
Total kw. hrs. generated	1,305,120
Total costs per kw. hr. 1941	1.84 cents
Average sale price per kw. hr. 1941 .	3.70 cents

WORTHINGTON *BEHIND THE NAME*

WORTHINGTON-BUILT AUXILIARIES

Starting Air Compressors

Cooling Water Circulating Pumps



Fuel Oil Transfer Pumps

Evaporative Condensers

DE4-1

Diesel engines, 150 to 2,600 hp. . . . Gas Engines, 175 to 2,880 hp. . . . Convertible fuel engines, 150 to 1,730 hp.

Controlled Quality...

THROUGH ACCURATE ANALYSIS MEANS ASSURED WELDABILITY

● In the Ladish Metallurgical Laboratories, trained technicians work with the finest equipment available to insure that your Ladish Quality Forged Steel Flanges will do the job for which they are intended . . . will have assured weldability.

The heat identity code, permanently stamped on every Ladish Quality Forged Steel Flange, means that certified reports of the work of the Ladish Metallurgical Engineering Laboratories attesting the chemical and physical properties of the steel are always available upon request.

Steel identity stamped on each flange was pioneered by Ladish and has been a Ladish standard for many years.

ARMY E NAVY

FITTINGS DIVISION

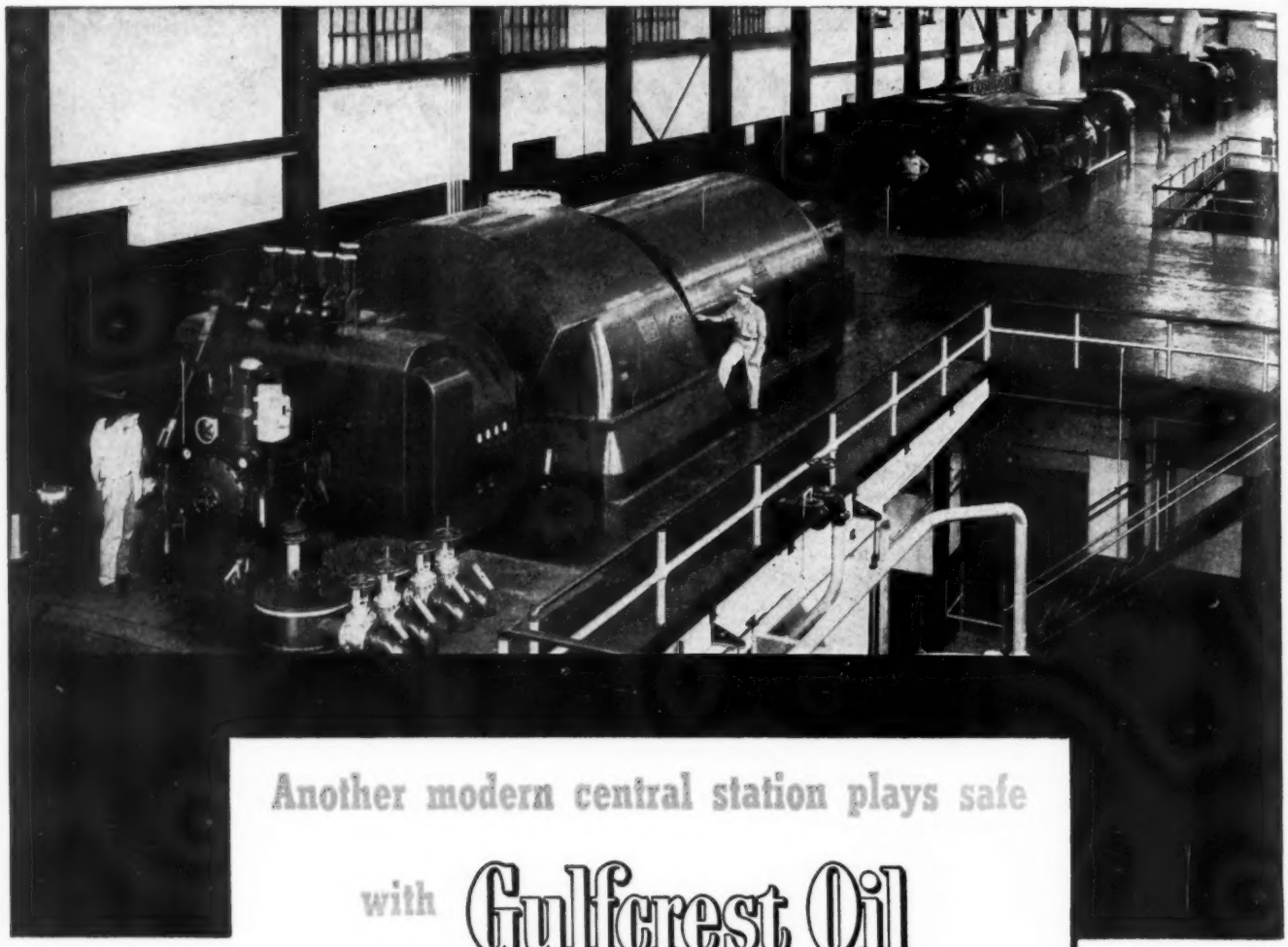
LADISH DROP FORGE CO.

CUDAHY • WISCONSIN

MILWAUKEE SUBURB

New York Office: 60 East 42nd Street, New York City

TO MARK PROGRESS



Another modern central station plays safe with Gulfcrest Oil

New 40,000 kw. units at Plant Arkwright of Georgia Power Company get the long lasting protection of this Alchlor Processed turbine oil

GULFCREST OIL has been selected by the Georgia Power Company for the turbines in the new high-pressure plant shown above. This modern central station with its three units of 40,000 kw. each is one of the finest in the South.

Here are the important reasons why so many power plants, large and small, choose Gulfcrest Oil to lubricate their turbines: (1) It is super-refined by the Alchlor Process, a most effective method for producing a turbine oil with maximum resistance to oxidation and sludge, (2) Gulfcrest has made records of unmatched performance in the turbine systems of many of the leading power plants in the country.

Ask a Gulf Lubrication Service Engineer to tell you more about this higher quality turbine lubricant. He will be pleased to give you complete details, without obligation.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation • Gulf Refining Company • Gulf Building, Pittsburgh 30, Pa.

BACK THE ATTACK...BUY MORE WAR BONDS!

COMPLETE *Variable Speed* POWER UNIT

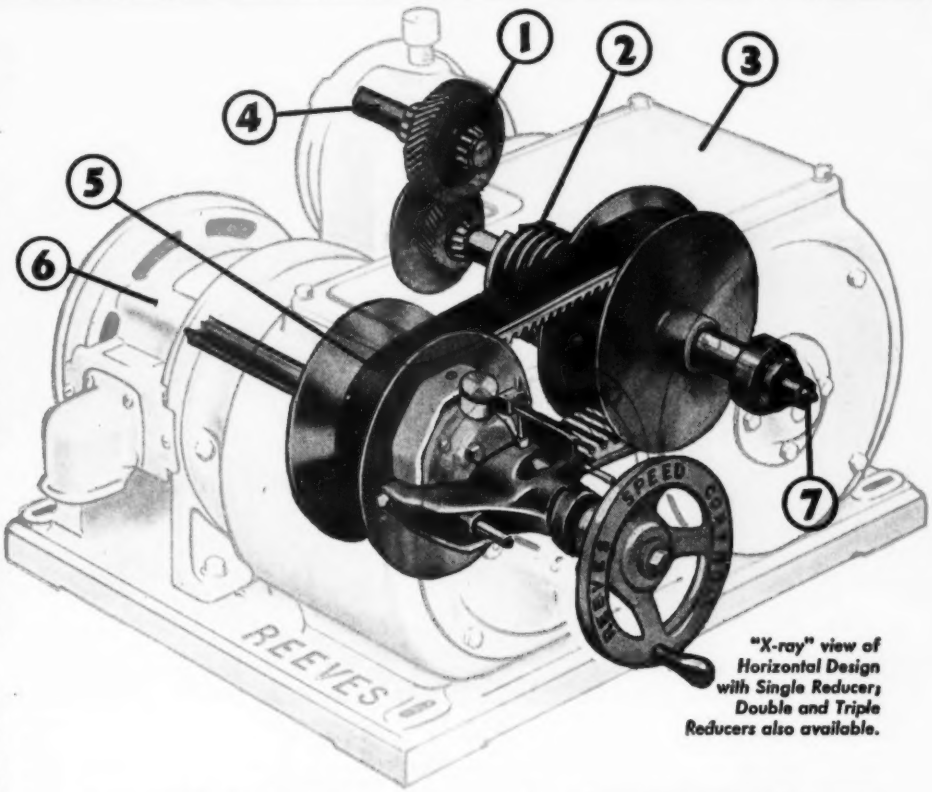
1. **HELICAL TYPE GEAR REDUCER** provides quiet transmission of gear load, better load distribution, longer life. Two or more angle-cut teeth in constant contact across gear face.

2. **TENSION SPRING** mounted on variable speed shaft, holds V-belt positively and automatically against disc faces. Makes it possible to secure maximum tension on belt at maximum speed, when maximum h.p. is required on unit and machine.

3. **ACCESSIBILITY TO OPERATING PARTS OF REEVES MOTODRIVE** is quick and easy. Simply remove four cap screws from cover plate. Removal and replacement of V-belt is readily accomplished.

4. **OUTPUT** variable speed shaft may be extended on either side of case—with or without reducer. A great convenience where wall, post or other obstacle might otherwise interfere; 13 different assemblies as to positions of motor, handwheel, shaft extension and reducer.

5. **V-BELT** is strong, endless cord construction, and held to minimum thickness to assure cool running and longer life. Very flexible, practically stretchless, of high tensile strength, evenly balanced in weight for proper load distribution. Transmits power smoothly and positively—without fluctuation or slippage.



"X-ray" view of Horizontal Design with Single Reducer; Double and Triple Reducers also available.

6. **ANY** standard foot-type, constant speed, ball-bearing motor may be used. Also several flange type motors.

7. **CONVENIENT LUBRICATION**—All operating parts lubricated through six force-feed fittings and 1 cup-type.

REEVES Motodrive

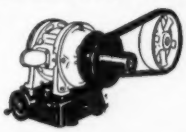
Motor Plus Variable Speed Plus Gear Reducer in one Compact, Enclosed Unit

Output speeds from 1.35 to 3480 r.p.m. may be secured with the REEVES Motodrive through the many different combinations of sizes, speed ratios and reduction gears available. Thus this modern, totally enclosed, compact unit meets practically all requirements for variable speed within 15 h.p. capacities. Widely used on machines where space is limited or where direct connection between motor and machine is desirable. Takes any standard foot-type, constant speed motor. Like all REEVES units, the Motodrive is simple, rugged, accurate. Transmission of power is absolutely positive at all speeds. Handwheel or Electric Remote Control. Space-saving vertical and horizontal designs. Easily applied to any driven machine. Write for Catalog A-441, giving full information.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

The Two Other Basic Reeves Units

VARIABLE SPEED TRANSMISSION for providing infinite speed regulation over wide range—2:1 to 16:1. Sizes fractional to 87 h.p.



VARI-SPEED MOTOR PULLEY converts any constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 h.p.

REEVES *Accurate Variable* Speed Control

Add This One To America's Oil Reserves!

FUEL-OIL conservation is not a wartime measure for owners of Cleaver-Brooks steam generators. They practised it and benefited from it long before Pearl Harbor.

An average of one *less* tank-car of fuel-oil is consumed annually in hundreds of industrial plants because Cleaver-Brooks steam generators have replaced less efficient fuel-oil steam generating equipment in such plants. Every tank-car of fuel-oil is precious today and the hundreds so conserved are a substantial contribution to the nation's reserves.

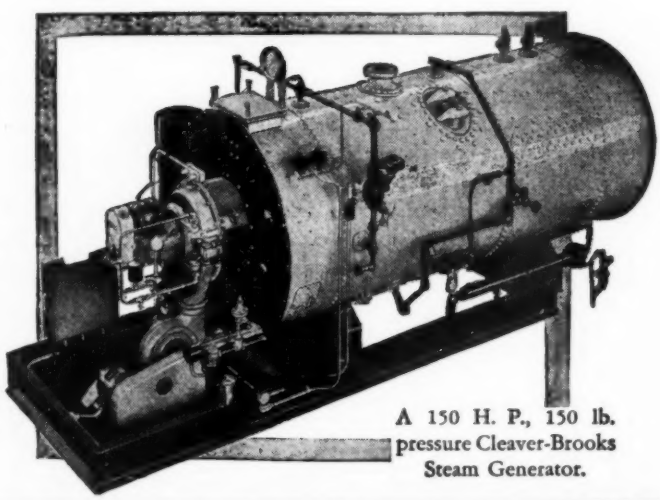
Cleaver-Brooks steam generators are thrifty with fuel (thermal efficiency of more than 80%) because of the original and exclusive Cleaver-Brooks four-pass, down-draft construction of the boiler with its long fire-travel and especially designed burners.

Quick steaming capacity—minimum manpower needed for operation and maintenance—cleanliness, no smoke, ashes, clinkers—compact space saving design—simple low-cost installation—dependable performance are all added advantages.

Get complete information now—for the future—on Cleaver-Brooks steam generators—20 to 500 HP.; pressures 15 to 200 lbs.

CLEAVER-BROOKS COMPANY
5103 N. 33rd Street Milwaukee 9, Wisconsin

Send for our instant Steam Cost Calculator for figuring steam costs using coal or oil fuel. Yours for the asking.



A 150 H. P., 150 lb. pressure Cleaver-Brooks Steam Generator.

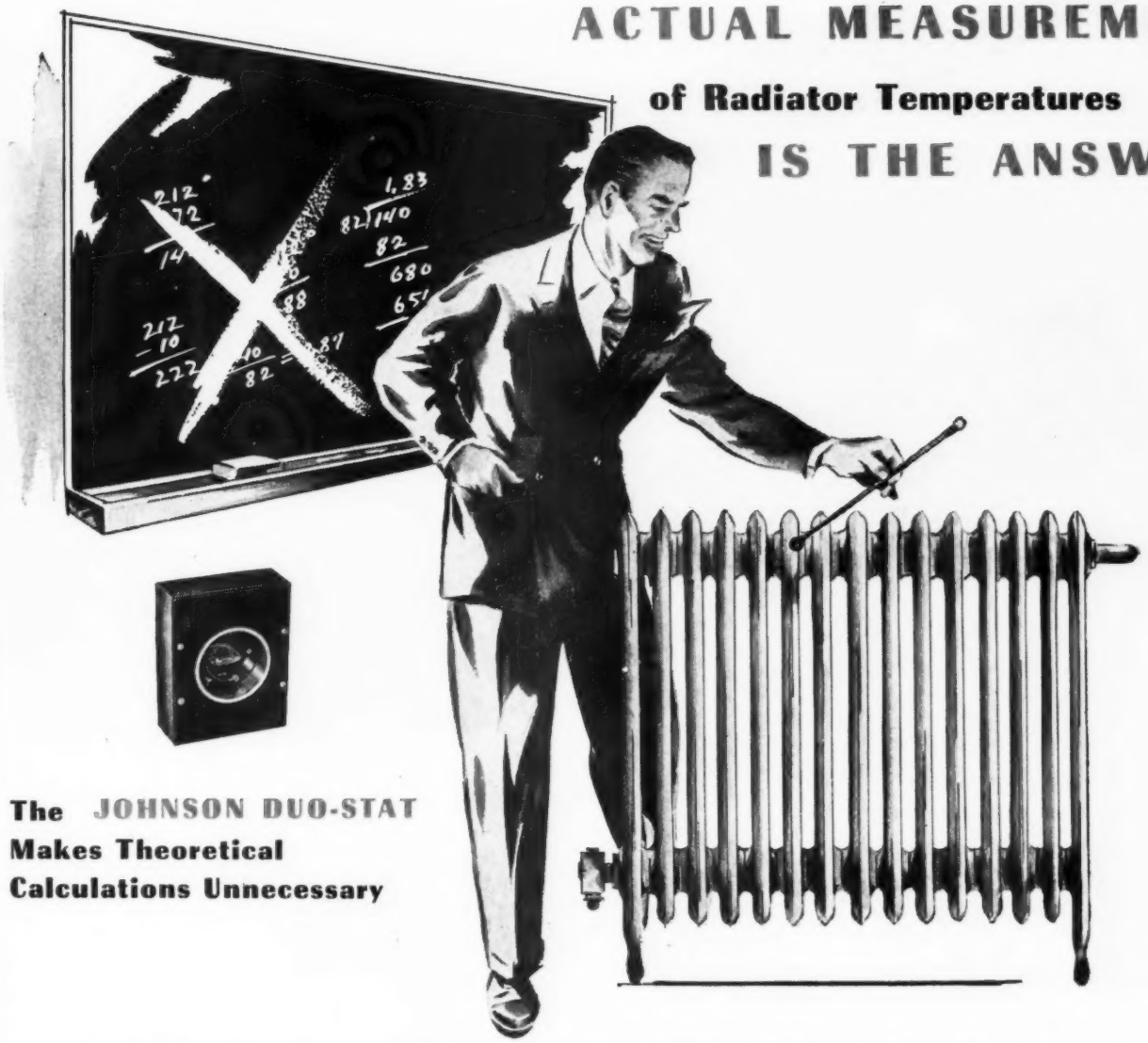
Cleaver-Brooks
STEAM GENERATORS

For MAXIMUM Fuel Conservation—

ACTUAL MEASUREMENT

of Radiator Temperatures

IS THE ANSWER!



The JOHNSON DUO-STAT Makes Theoretical Calculations Unnecessary

The Johnson Duo-Stat *actually measures* the temperature of the heating system and adjusts that temperature as demanded by outdoor weather conditions. Radiators are full of steam during coldest weather. However, for the greater portion of the heating season, they are only partially filled. This inevitably results in *greatest fuel economy!*

One Duo-Stat may control the temperature of an entire building at the street steam main or automatic firing device. In larger buildings, Johnson Zone Control provides a separate Duo-Stat to operate the valve in each branch main. Installed in existing or new buildings with equal facility . . . Hundreds of Duo-Stats are in successful operation. Actual records show fuel savings of 25% and more. Ask a Johnson engineer from a nearby branch office, or your heating contractor, to make a survey and recommendations. Explanatory bulletins will be sent, without obligation, upon request.

BUY MORE BONDS!

JOHNSON

Fuel Saving Starts With CONTROL

Automatic TEMPERATURE AND AIR CONDITIONING *Control*

JOHNSON SERVICE COMPANY, MILWAUKEE 2, WISCONSIN • DIRECT BRANCHES IN ALL PRINCIPAL CITIES

HAVING TROUBLE INSULATING BENDS?

SIMPLY APPLY UNIBESTOS
it's simple to apply!

Unibestos, the sectional insulation for all pipe sizes, permits easy application on even the most difficult-to-insulate expansion bends. Makes a clean, neat job. Unibestos is available in half-section form up to 30" pipe diameter and in quarter-sections from 32" to 60", in thicknesses from ¾" to 5". Available in single layer construction for service up to 1200°.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

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PATERSON, N. J. • BLUE ISLAND, ILL.
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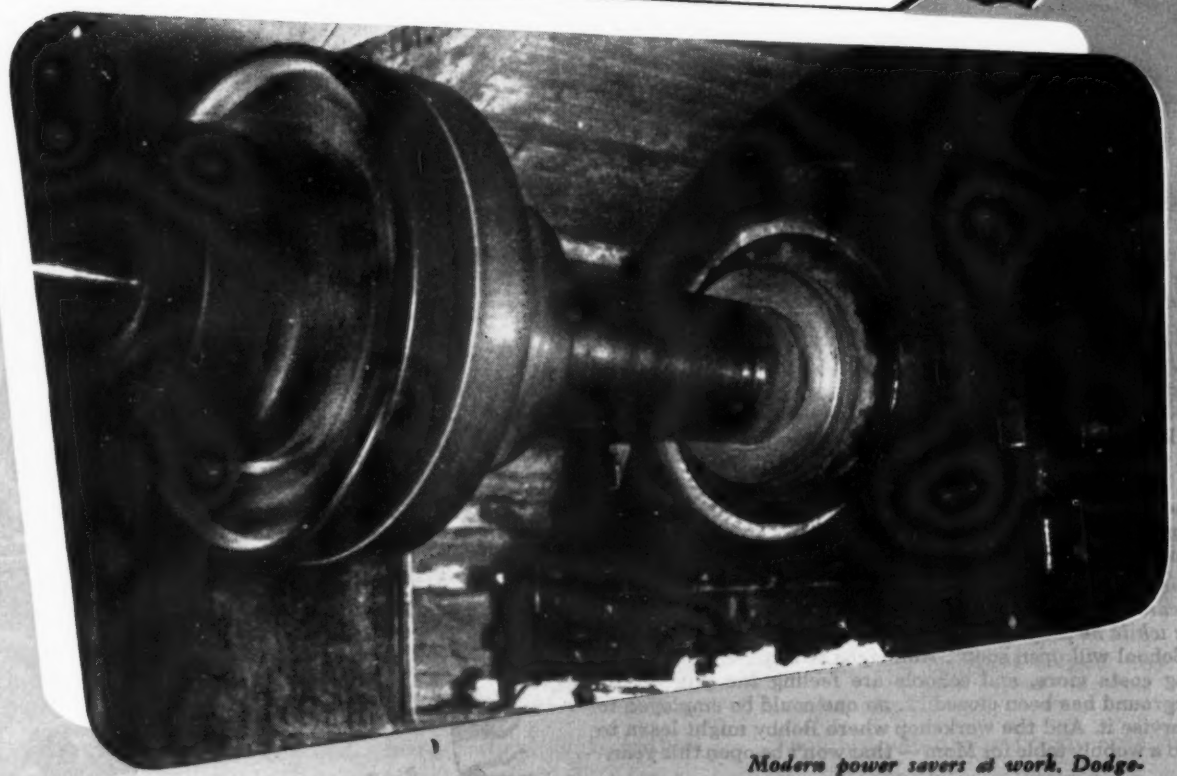
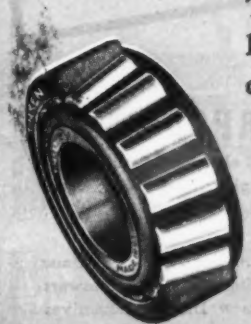
Are You Getting Full Value From The Power You Use?



Modern power savers at work. Dodge-Timken Special Duty Pillow Blocks.

You pay for power whether you use it or waste it. Are you receiving full value in work done from the power you are paying for? How much of the power that enters your plant actually gets to the points of application? How much is lost — burned up by friction in obsolete line shaft hangers and pillow blocks?

Get the answers to those questions *now* by checking up on every power transmission unit in your plant and replace every power waster with modern power savers equipped with Timken Tapered Roller Bearings. Then you will not only save power; you will also save lubricant; lengthen the life of transmission shafts; and prevent damage to, or contamination of your product through lubricant leakage.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

These advantages will be yours now and for many years to come when you specify "Timken Bearing Equipped". The Timken Roller Bearing Company, Canton 6, Ohio.

Did you put My Son on the Streets?

Dirty looking little fellow, isn't he? And did you ever hear such language? What kind of parents must—

Just a minute, please—that's what we wanted to talk to you about. Because we happen to know Bobby Greenleaf's Mom and Pop . . .

You know them, too.

When Brad Greenleaf shipped out, he left behind the two most important people in the world... his young wife Ann and tow-headed, ten-year-old Bobby. They were a nice family — the kind of folks you'd like to see moving in next door.

It wasn't so bad for a while. But then costs began to creep up . . . slowly, insidiously. Ann cut corners where she could in her cheerful suburban cottage. But finally she was forced to move into a section of the city where rents were low, lawns didn't have to be cut, and houses heated.

Dirty looking, isn't he? He spends his time hanging around the candy store, watching the older boys shoot dice, dodging cars while he plays ball in the street.

"School will open soon", Ann sighs with relief. But everything costs more, and schools are feeling the pinch. The playground has been closed . . . no one could be employed to supervise it. And the workshop where Bobby might learn to build a wobbly table for Mom — that won't be open this year.

What have *you* got to do with it?

Not much . . . and yet, perhaps everything. Did you add a little extra on that railroad ticket when you just *had* to have a reservation? Did you rent your house this summer for three times what you got last year? Did you whisper to the butcher that if ceiling prices stood between you and a choice sirloin, you'd be glad to . . .

Sure — sure, they're small things. But any violation of price control or of normal business dealing reduces the purchasing power of the few dollars Ann gets as a soldier's wife. Schools, libraries, hospitals — all institutions and individuals operating on a fixed income must cut down to survive when the dread drive of inflation forces prices higher and higher, out of reach of needy hands.

No, of course you didn't put Brad Greenleaf's boy on the streets, while he was off fighting your war. And it won't happen if you can do anything about it.

You can. Will you?

PLAY FAIR WITH AMERICA'S CHILDREN — KEEP PRICES DOWN! DO THESE THREE THINGS—

Encourage our representatives in Washington to tax our extra income away. Hard, yes, but not as hard as inflation and saddling our children with War's cost.

Follow the price control rules. Sure the government agencies have made mistakes. But they're the best we've got and they can do the job if we support them.

Save—invest in War Bonds for America's post-war future and your own. The suckers are the ones who are spending — not the ones who are saving. Think that through.

ROGERS DIESEL AND AIRCRAFT CORPORATION

1120 Leggett Avenue, New York 59, N.Y. Builders of diesel-electric equipment and aircraft parts for our armed forces. *Divisions:* Hill Diesel Engine Company, Edwards Company, Edwards Aircraft Products, Inc., Ideal Power Lawn Mower Company.

Diesel Engines, 5 to 2000 h.p. » Gasoline Engines » Generator Sets » Generators » Power Units Switchboards » Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms » Power Mowers Power Brushes » Snow Removal Equipment » Streamlined DeLuxe Railway Motor Trains » Diesel Locomotives

TRADE MARK REG.

COMPLETE REPRINTS of this message for poster use will be supplied upon request, subject to the limits of our paper allotment.

Here's a "GENERAL" ...WITH THE VICTORY HABIT!

Fuel-Saving Starts With CONTROL

JUST as certain leaders have a genius for training their men into efficient, hard-hitting, unbeatable fighting units, so Hays Combustion Control "gets the best" out of a steam power plant — makes it an efficient, smooth operating economical plant. Its automatic performance conserves man power.

Here, indeed, is a "general with the victory habit." Your Hays Combustion Control regulates every element of combustion, makes each one function at its best. It maintains a perfect balance — measures each variation, and corrects it instantly: all automatically.

Stretching steam capacity safely, getting top efficiency out of existing boiler room equipment, saving man-hours and fuel costs—Hays Combustion Control is a vital factor in meeting the extra demands put on industry by the war.

Use this capable commander in your own campaign against inefficiency and waste. The Hays Combustion Control catalog, full of helpful steam-power data, tells how. Send for it today.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

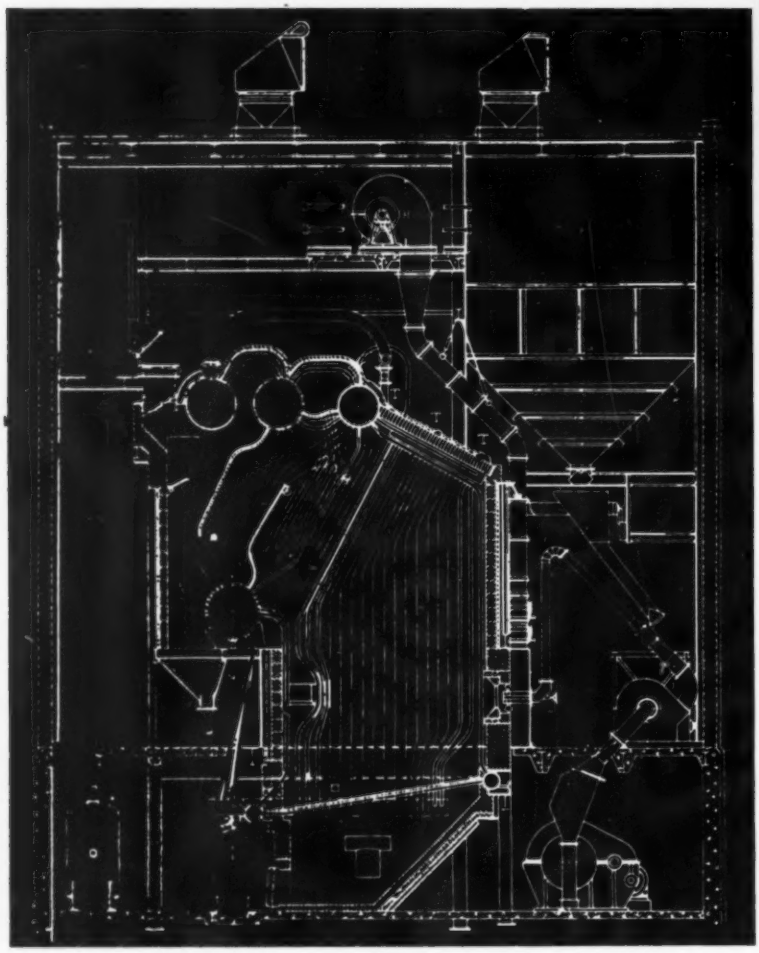
THE HAYS CORPORATION • MICHIGAN CITY, IND.

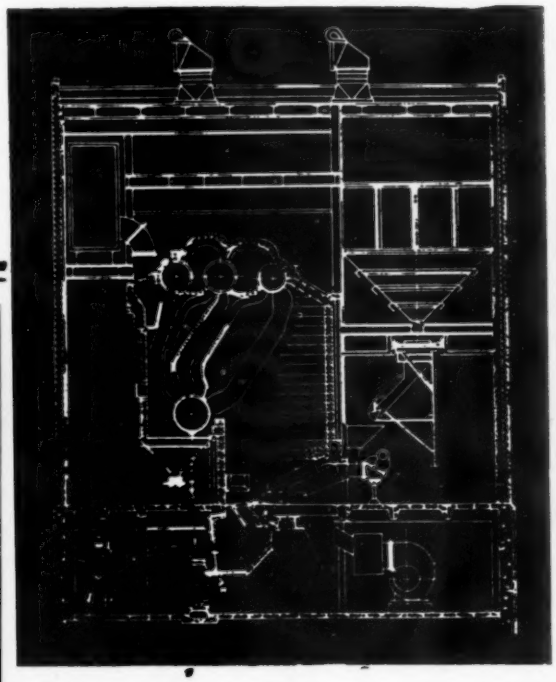
$20,000 a year SAVED in COAL COSTS

By Converting to Pulverized Fuel

•

KENNEDY *Air-Swept* TUBE MILL
makes this economy possible through ability to burn low grade fuel . . .





BEFORE (ABOVE)

Showing one of two boilers in Ohio Municipal Power Plant before conversion. The boilers together carried an average load of 35,000 lbs. per hour. The fuel used was the best Imported West Virginia Coal.

AFTER (LEFT)

The same boiler after conversion and installation of *Kennedy Air Swept Tube Mill and Water Walls.* The capacity of each boiler was increased 33% to 47,000 lbs. per hour, permitting the load to be carried by one boiler with the other held for stand by. The fuel now burned is Ohio Strip Mine Coal costing $1.50 less per ton than formerly. Boiler efficiency is now 80%. Saving: $20,000 a year in coal costs.

YOU, TOO, CAN MAKE SAVINGS

Now is the time to start rehabilitating your boiler plant. All signs indicate that the coals available in the future will be lower in grade and more difficult to burn. This prospect emphasizes the necessity for converting existing plants to burn lower grade coals efficiently. Kennedy-Van Saun is prepared to help you meet this new condition and offer valuable suggestions for solving the problems that lie immediately ahead. You are invited to consult freely with our engineers on any plans you are making for plant installation or rehabilitation.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

Factories: Danville, Pa., Canada, England, Australia

THIS BOOK TELLS YOU HOW TO DO IT—MAIL COUPON

ARMY E NAVY

Kennedy-Van Saun Mfg. & Engr. Corp., 2 Park Ave., New York 16, N. Y.

Kindly send me Bulletin No. 12 explaining how lower grade coals can be burned efficiently:

Name..... Position.....

Company.....

Address..... .....P-8-44

HIGH TEMPERATURES MOISTURE CORROSIVE FUMES

CAUSING WIRE-FAILURES?

THE ROCKBESTOS CONSTRUCTION THAT PROVIDES LONG WIRE LIFE

Rockbestos A.V.C. Power Cable, above, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1 The conductor is perfectly and permanently centered in helically applied insulation.

2 Felted asbestos insulation, impregated with heat, flame and moisture resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

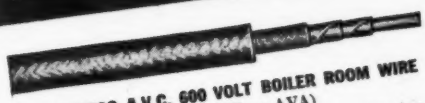
3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Outer felted asbestos wall, also impreganted with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

5 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot — resists moisture, oil, grease and fume

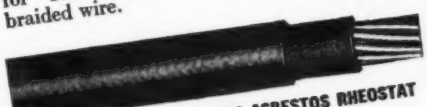


ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE

(Underwriters' Type AVA)

Sizes No. 18 to 4/0 AWG. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

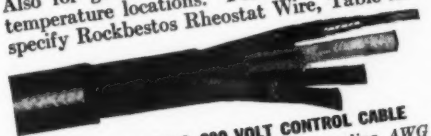


ROCKBESTOS 600 VOLT ALL-ASBESTOS RHEOSTAT CABLE

(Underwriters' Type AI)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of her oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

Install ROCKBESTOS A.V.C. for trouble-free wire Performance

If you are having repeated wire-failures in electrical circuits that run around furnaces, lehrs, kilns, steam tunnels, soaking pits . . . places where wire insulation is exposed to excess heat, moisture, corrosive fumes, and other destructive elements . . . then install Rockbestos A.V.C.—the wire with the *permanent insulation* and a maximum operating temperature of 230° F.

Rockbestos A.V.C. stands up where other wires fail because its *permanent* asbestos — varnished cambric insulation and heatproof, flame-proof, moisture-resistant asbestos braid won't bake brittle, dry out, crack, bloom, rot or swell under heat, vibration, alkalies, oil, grease or corrosive fumes.

Prevent repeated wire-failures and equipment shut-downs . . . wire all "hot-spot" locations with Rockbestos A.V.C. 122 standard constructions are available to fit practically every service requirement. When inquiring or ordering, please furnish CMP allotment number or symbol and certification. For complete information and samples, write nearest branch office or:

Rockbestos Products Corporation, 955 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.,

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

Generate the Electric Power at

BROWN & BIGELOW

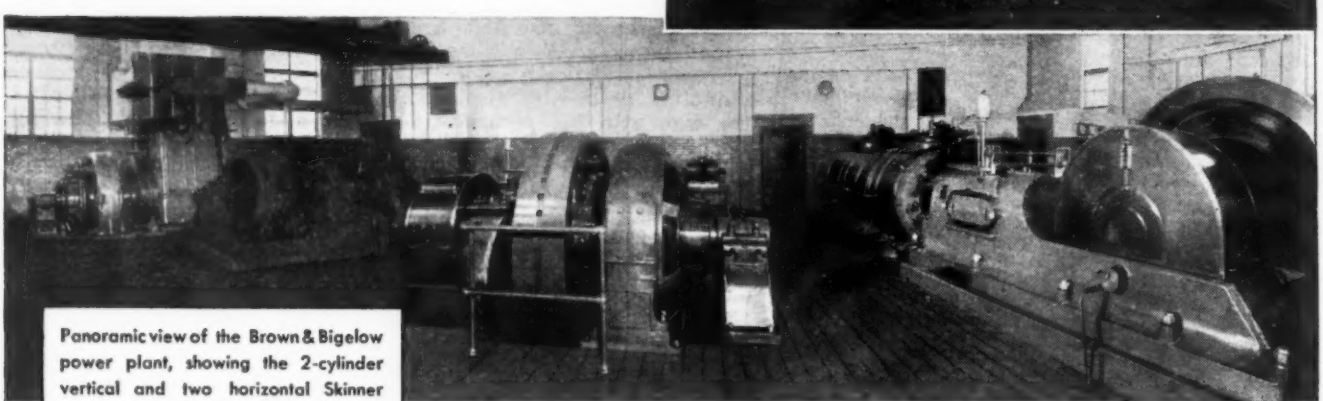
"Remembrance Advertising"
REG. U. S. PAT. OFF.

SAINT PAUL, MINNESOTA

HOUSED in this stately building, with its classic Greek columns and attractive facade, are the giant printing presses and various kinds of machinery which produce the beautiful art calendars and the "thousand and one" clever, useful items of Remembrance Advertising, that have earned for Brown & Bigelow the reputation as "The House of Quality" in the advertising specialties field.

To produce this merchandise economically requires an abundant supply of unfailing and low cost power. Since 1922 this company has been generating its electric power with Skinner "Universal Unaflow" Steam Engines—utilizing the exhaust steam for heating and processing purposes. By so doing, the farsighted, efficient management has saved, and will continue to save, many thousands of dollars in power costs.

Like Brown & Bigelow, more than 2,000 power users in industries and institutions of various types are making savings by producing electric power with Skinner "Universal Unaflow" Steam Engines. Case studies pertaining to your particular industry will be sent upon request. Our research and engineering departments are available now to discuss your power costs for the future.



Panoramic view of the Brown & Bigelow power plant, showing the 2-cylinder vertical and two horizontal Skinner "Universal Unaflow" Steam Engines.

Do More Than Before—Buy EXTRA War Bonds

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

NO "GLAND TROUBLE"

Because UNITROL level Controller has no packing glands or stuffing box

On recirculator systems of condenser hotwells, deaerators—or wherever the level of liquids must be controlled—UNITROL will do it more accurately! Simple . . . self-contained . . . this exclusive design eliminates trouble-making restrictive elements. Friction is minimized. Action is free and unhampered. Feed or drain is regulated promptly and positively. The float is linked to the inner valve through ratio connection, with maximum float travel on any size valve of only 7 inches. Available for temperatures up to 750° F.—in valve sizes ½" to 4"—integral casting construction—valve and float-cage of semi-steel or cast steel—float of seamless copper or stainless steel—and with the fine craftsmanship for which K & M has been recognized for 75 years. Our Engineering Department will be glad to make specific recommendations.

Write for General Catalog 66

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
NORTH BERGEN, NEW JERSEY

Awarded our employees for outstanding production achievement

TURN TO PEABODY . . .

TO TURN ON THE HEAT

DIRECT FIRED AIR HEATER
OIL PUMP AND HEATER SET
MARINE OIL BURNER
REFINERY BURNER FOR GAS AND OIL
COMBINED COAL AND OIL BURNER
COMBINED GAS AND OIL BURNER
GAS AND AIR SCRUBBERS, COOLERS, ABSORBERS
BLAST FURNACE GAS BURNER

BURNERS — Peabody builds burners for natural and forced draft — for rich and lean gases, oil and pulverized coal, fired singly or in any combination.

HEATERS — Peabody high pressure, high temperature air heaters — direct fired, burning oil or gas, or both — have many uses in catalytic plants, in gas turbine operation, etc.

GAS AND AIR SCRUBBERS, COOLERS OR ABSORBERS — Peabody Scrubbers remove unwanted substances, such as dust, ash, fume and bacteria from gas and air.

BLAST FURNACE GAS BURNERS — The Peabody Blast Furnace Gas Burner is a large capacity unit of high efficiency. It can be supplied for firing in combination with other fuels.

OIL PUMP AND HEATER SETS — Peabody builds them for power plants, ships and industrial installations.

Peabody equipment is the product of years of concentration and specialization in the field of combustion engineering. Specify it for your plant and let Peabody engineers assist in working out your requirements.

To turn on the heat, turn to Peabody

PEABODY ENGINEERING CORPORATION

580 FIFTH AVENUE • NEW YORK

ATLANTA
BOSTON
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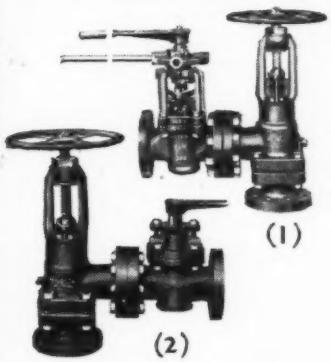
BUENOS AIRES • MEXICO CITY • MONTREAL

PEABODY LIMITED, LONDON

The EXTRA SEAT and DISC

mean DOUBLE SERVICE LIFE!



Hovalco Angle Valves used in combination with (1) Homestead Lever-Seald or (2) Cam-Sealed Quarter-Turn Valves meet the requirements of A.S.M.E. code and all state laws for boiler blow-off service. Made in 1½"—2"—2½" sizes for pressures up to 600 pounds.

HOVALCO BOILER BLOW-OFF VALVES

- *Are built to outlast the boiler*
- *Reduce maintenance costs by 30% to 60%*

Inside every HOVALCO BOILER BLOW-OFF VALVE is an "extra" set of accurately-ground, perfectly-matched *seating surfaces* ready to be put into service quickly and easily, when the need arises. By simply unbolting the lower valve body and turning over the special high-silicon monel seat and disc, you have a good-as-new valve ready to give *another* extra long lifetime of service.

That's why Hovalco Blow-Off Valves give double-service life and often outlast the boiler on which they are installed. Also, certified performance records show that their maintenance costs are 30% to 60% lower than those of other valves.

For double service life and lowest cost-per-year maintenance, specify HOVALCOS for your next boiler blow-off job. Choose sizes and types for your condition from Valve Reference Book No. 38. Write today.

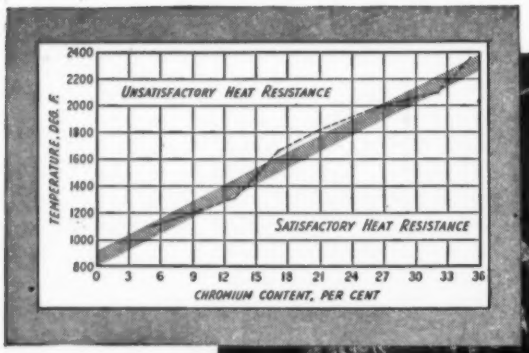
"M" Pennant with three additional gold stars—Maritime's highest production award to our men and women making valves for the Victory Fleet.

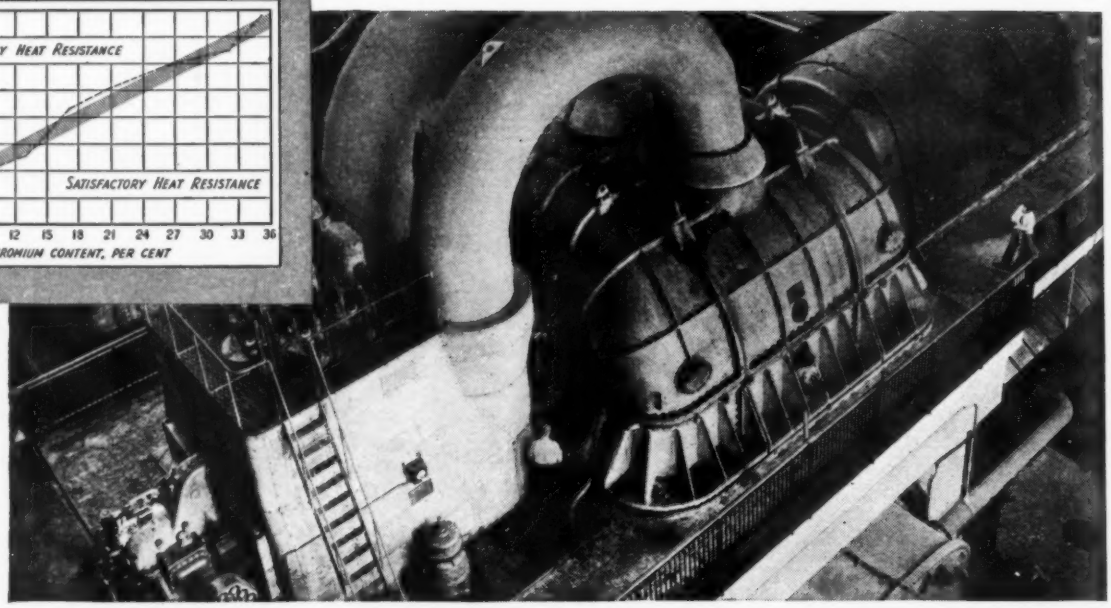
HOMESTEAD VALVE MFG. CO.

P.O. BOX NO. 210 CORAOPOLIS, PA.

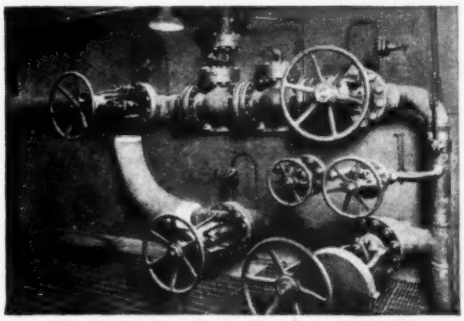
ON HOT JOBS . . .

Chromium Safeguards Equipment





This giant turbine has blades of corrosion-resistant chromium steel.

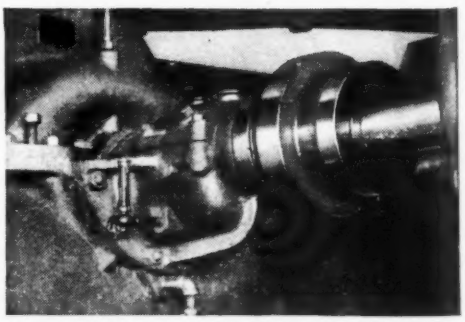


Valve stems and discs of this "valve nest" on a high pressure boiler are of stainless steel.

• Chromium irons and steels can stave off the oxidation that ruins power equipment where high temperatures are encountered. Stainless steel turbine blades withstand the corroding and eroding effect of superheated steam. Even the high pressure and extreme temperature to which convection superheater tubes are subjected will not affect the chromium steel of which they are made. Chromium cast iron stoker parts resist abrasion and growth in the heat of furnaces.

Baffle castings, pump parts, valves, boilers, spacer castings, and tile supports, — all are made of chromium iron or steel to meet severe conditions.

Although we do not make iron or steel, we have produced ferro-alloys for many years and have accumulated a vast fund of data on the alloy steels in which they are used. The benefit of our experience is available to help the fabricators and users of equipment subject to extreme conditions. Write to us for further information.



The shaft of this pump is 18-8 chromium nickel stainless steel.

BUY UNITED STATES WAR BONDS AND STAMPS

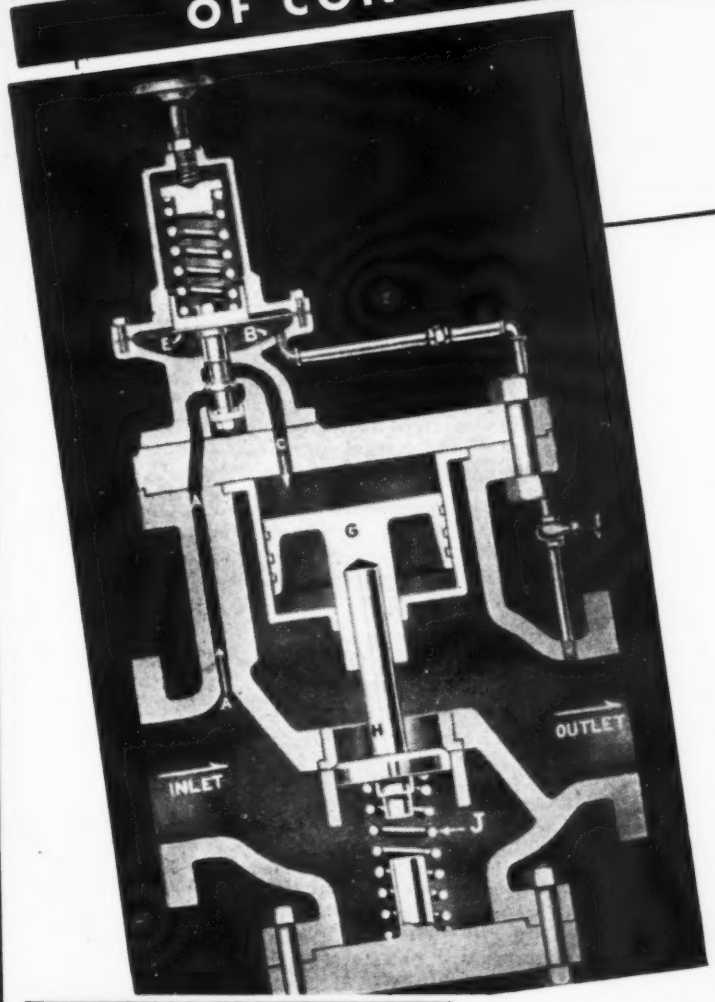
ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade Mark
Ferro-Alloys & Metals

GAVSCO STEAM PRESSURE REDUCER

Uniform Pressure

REGARDLESS OF CONSUMPTION!



Here's How It Works!

The GAVSCO Steam Pressure Reducing Valve features balanced pilot valve operation to sensitively maintain downstream pressure under varying flow requirements —and the main valve, being single seated, prevents downstream pressure from building up under "no-service" conditions.

These valves are constructed for extra heavy duty operation . . . thus there can be no distortion or warping caused by pipe line stress or strain. Units are supplied in Base Types or Globe Type Pilot Control. The Globe design permits mounting away from main valve or in any position piped adjacent to main valve. Valve trim may be Bronze, Monel, Stainless Steel or Gallavoy according to your pressure and temperature conditions. Seat ring and disc may be Stellited. Ten sizes are available, from 2" to 14", to handle working pressures from 250 to 600 lbs.

Write for your copy of the latest GAVSCO catalog . . . contains detailed descriptions of all GAVSCO Valves.

GOLDEN-ANDERSON
VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PENN.

WORLD'S BEST AUTOMATIC Valves

HERE'S HOW BUSINESSMEN RATE NEW YORK STATE

You are planning now for the postwar period. Here are facts, revealed in a poll of New York State manufacturers, of real importance to you. Unbiased opinions, of men who know from years of practical experience, rate New York as a good State in which to do business.

91% give approval to New York for the availability of *raw and semi-processed materials*—both produced in the State and imported.

92% endorse New York's unexcelled and diversified *transportation system*—railway and truck transportation plus waterway and port facilities that give it a time and rate advantage in shipping to mass markets.

91% like the *cooperativeness* of New York State *labor*. In 1943 New York lost a lower percentage of manhours due to strikes than any other industrial State.

97% praise New York as a *market*. Over a quarter of the nation's population and a third of the retail sales right at hand put the nation's number one market at industry's doorstep in the Empire State.

92% approve the service and cost of the State's electric, water and gas *utilities*. New York is the nation's number one powerhouse, with continuity, flexibility and low cost of service.

91% give an O.K. to New York for the service and cost of *fuel*—coal, oil and gas.

How You Can Capitalize On These Advantages

With such a favorable economic environment, New York State should be considered in your postwar plans. Wherever you are located, the State Department of Commerce can help you. We can assist you on plant locations; supply information on manpower; get you a preview of taxes for a new enterprise; give technical service on new materials and new products; help promote opportunities in foreign trade.

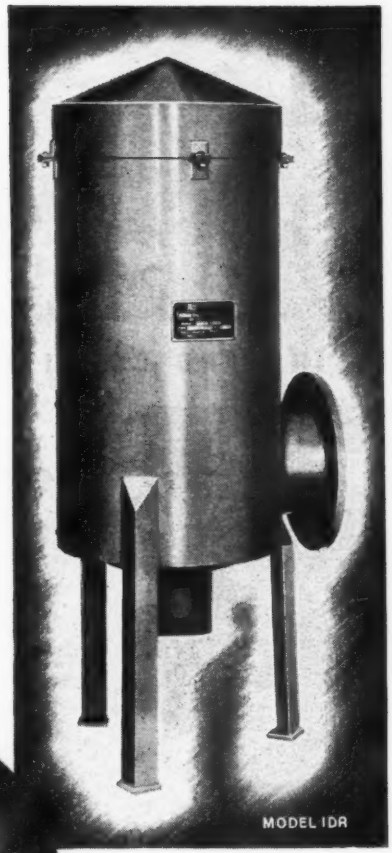
Accept This Informative Book

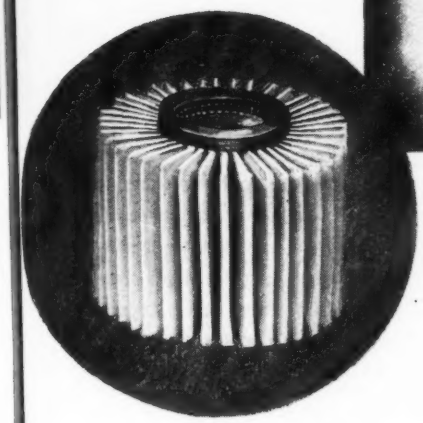
The services we can render are fully described in our new book "New York Means Business." In it business men tell in their own words their experience with labor, transportation, markets and other factors of doing business in New York. Send for your copy on your business letterhead.

ADDRESS: M. P. CATHERWOOD
COMMISSIONER
NEW YORK STATE DEPARTMENT OF COMMERCE,
ALBANY 1, NEW YORK

NEW YORK MEANS BUSINESS

new STAYNEW Intake Air Filter





EXCLUSIVE RADIAL FIN CONSTRUCTION PROVIDES:

- ★More Filtering Area
- ★Greater Efficiency
- ★Less Resistance
- ★Less Frequent Servicing

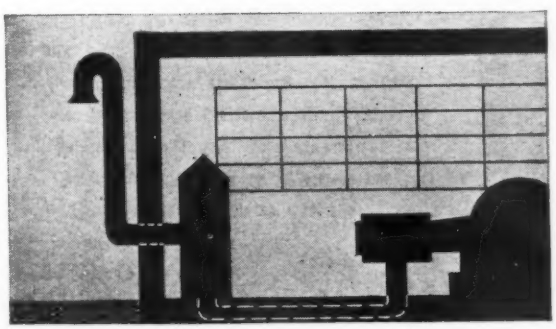
ALL THE CONVENIENCE OF GROUND LEVEL INSTALLATION

ALL THE EFFICIENCY OF HIGH LEVEL AIR INTAKE

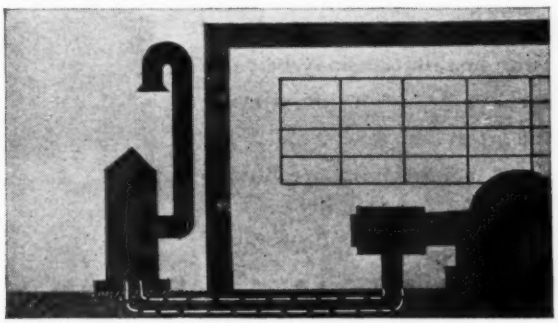
NOW you can equip compressors and internal combustion engines with a Staynew filter providing all the recognized advantages of the famous Protectomotor line . . . *plus* an exclusive combination of two new features.

The new filter, Staynew Model IDR, or IDRS (Silencer), is so constructed that *installation and servicing can be effected at ground level* (right in the engine room itself if preferred), and the *actual air intake located at the most suitable point.*

Models available with solid base for installation when compressor or engine intake is below floor level.



Model IDR INSIDE Engine Room



Model IDR OUTSIDE Engine Room

Engineering Data on request STAYNEW PROTECTOMOTOR FILTERS Representatives in Principal Cities

DOLLINGER CORPORATION

(Formerly Staynew Filter Corporation)

23 Centre Pk.

Rochester 4, N. Y.

LOOK to CLARAGE

FOR WAR AND POST-WAR AIR HANDLING AND CONDITIONING EQUIPMENT

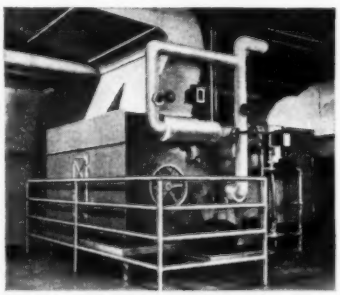
Today, as since Pearl Harbor, Clarage is playing an important part in meeting the enormous demands of industry, shipbuilding and government for air handling and conditioning units.

★ Tomorrow, after Victory, our long pre-war experience, plus notable research advancements born of war, will prove *exceedingly profitable* to those with peace-time requirements.

★ If you have an immediate and war-essential problem, look to Clarage NOW for units expertly designed and specifically built to your particular job — *and for prompt deliveries.*

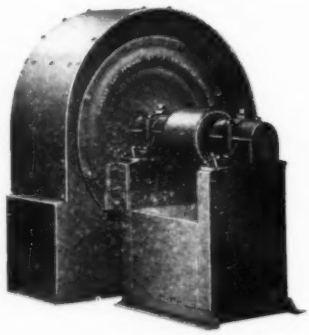
★ Or, if you are thinking in terms of post-war service, look to Clarage NOW for any desired planning and cost-determining assistance.

★ Thus, when the time comes for action, your installation may be completed without delay and may incorporate the latest improvements in air handling or conditioning technique and equipment.



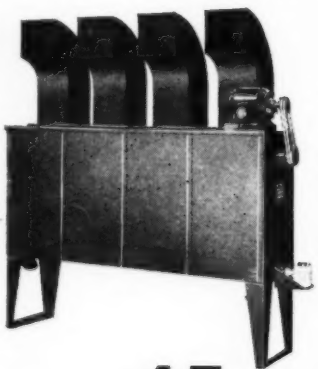
AIR CONDITIONING

Clarage builds both central station and unit air conditioners — suitable for complete conditioning, heating or cooling, humidifying or dehumidifying. The unit conditioners (floor and suspended types) can be easily installed without costly building alterations; used with or without duct work.



EXHAUST FANS

Clarage Exhaust Fans are made to cover all kinds of exhaust and blow pipe and pneumatic conveying requirements; used for dust collecting, removing fumes, and for conveying through pipes such materials as shavings, grains, etc. Fan Wheels statically and dynamically balanced. Famous Clarage dust-proof, oil-tight bearings standard equipment.



LARGE AREA HEATERS

Clarage Unitherm Unit Heaters are designed for service in factories, mills, etc. Equipped with centrifugal fans, they deliver heat at high velocity spreading it over wide areas. Both floor and suspended types available. Also Clarco (propeller fan) unit heaters for small factory areas, offices, stores—easily installed along walls or at ceiling.

IMMEDIATE HELP IN 45 CITIES

Each Clarage branch office is manned by experts — by Clarage engineers long experienced in satisfactorily meeting air handling and air conditioning requirements of every conceivable kind.

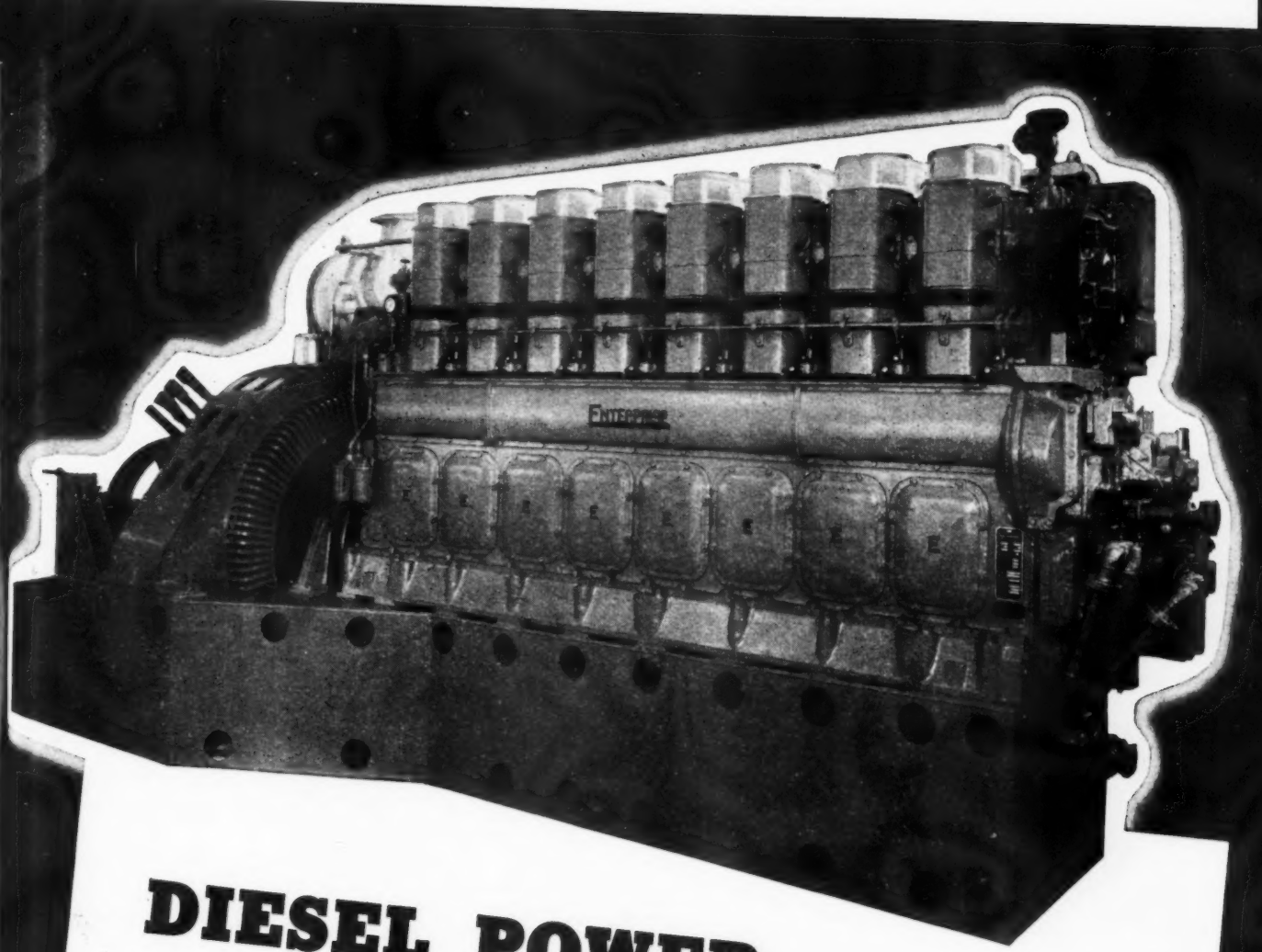
★ *Whether you have a war-time or post-war problem, you will find these application engineers eager to cooperate. You will like the intelligent way in which your inquiry is handled.*

★ Illustrated above are only a few of the units and systems built by Clarage. Write for catalog showing our complete line.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES



DIESEL POWER FOR MODERN INDUSTRY

Industries must face the post-war era with the assurance that their power facilities are adequate and economical. Enterprise Diesel Engines fulfill the demands of modern industry for peak output from production equipment or for power generation. Designed for unusual fuel and lubrication economies, Enterprise Diesels are proven power-plants that have gained noteworthy recognition for their ability to operate over long periods of sustained performance without maintenance and overhaul.

Since 1886 Enterprise has engineered meritable equipment for industry.

Ruggedly built and conservatively rated from 225 HP to 1450 HP to meet normal demands . . . Turbocharged to 2100 HP for above normal and intermittent needs, Enterprise 4-cycle Diesels fulfill operation requirements in all climates . . . at sea level or high altitudes. They are constructed in three essential sizes, each of which is built in 6 or 8 cylinders. Full engine enclosure seals out abrasive dust and grit. Enterprise Diesels have earned their place as power for modern industry.

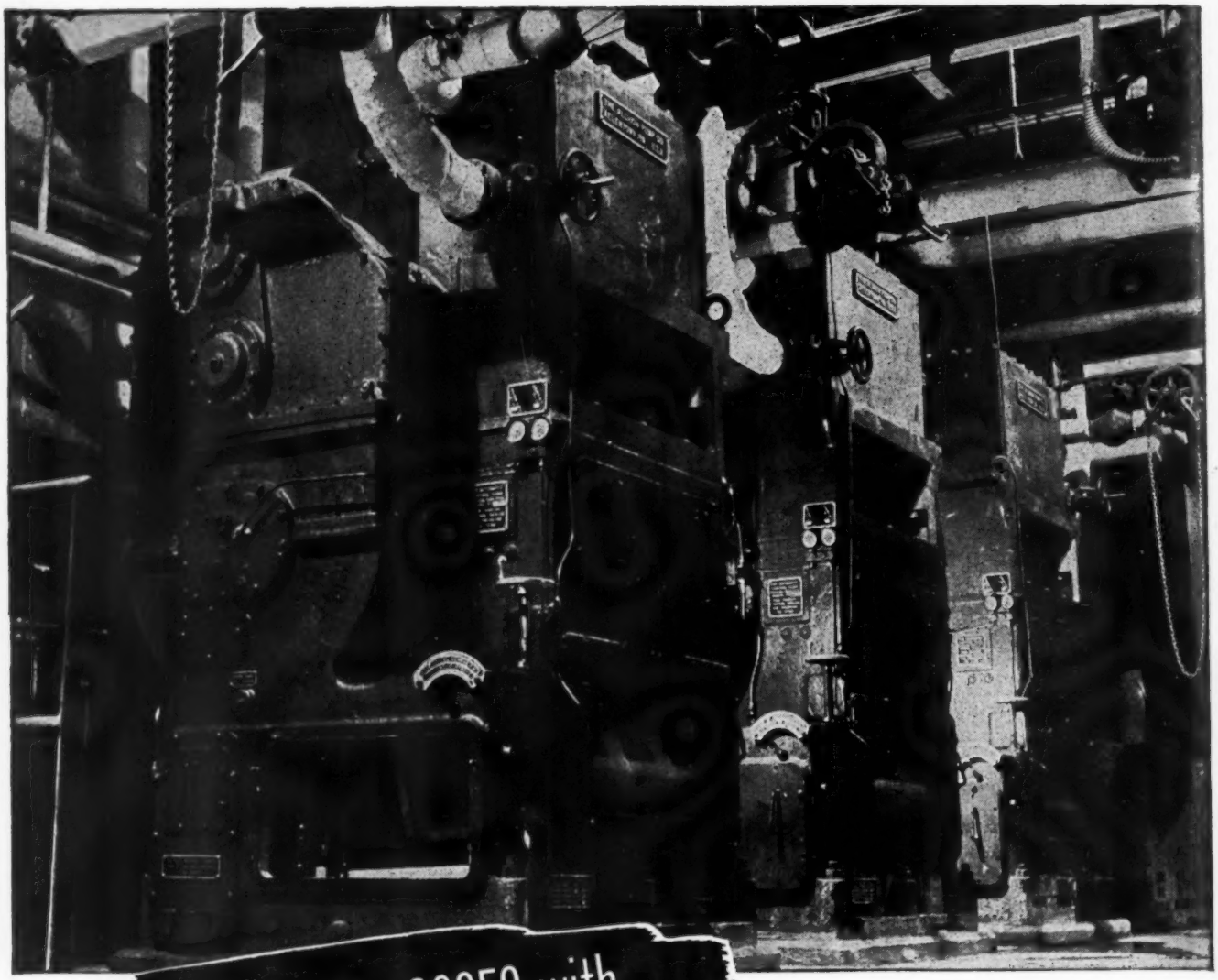
New Illustrated Catalog No. 192 of late models gladly sent on request.

ENTERPRISE ENGINE & FOUNDRY CO.

SAN FRANCISCO
SEATTLE

Enterprise DIESEL POWER

WASHINGTON, D.C.
NEW YORK



CUT POWER LOSSES with . . .

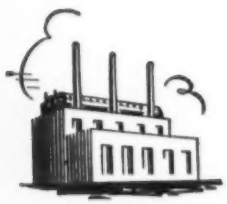
. . . ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMPS

Aldrich-Groff pumps on unit feed systems eliminate pressure and power losses common to throttling-type feed regulating valves and offer advantages of feed system simplicity, efficiency and mechanical reliability for small and medium installations at medium and high steam pressures.

Equally important overall power savings are effected by Aldrich-Groff pumps on de-superheater feed service in connection with high pressure topping units for power stations of any size.

The three Aldrich-Groff 3¼" x 0 to 6" variable stroke vertical triplex pumps shown above are in service in a mid-western central station employing the unit system for main boiler feed. Two are driven by constant speed motors and the third by a constant speed steam turbine. Power consumption is almost directly proportional to pump delivery.

The 6" stroke — 3¼" plunger pump is a 100 HP unit and when operating at maximum speed can deliver 70,000 pounds of feed water per hour against 1025 pounds boiler pressure.



WRITE TODAY . . .

for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP CO. ALLENTOWN • PENNA.

Representatives: **Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Los Angeles • Pittsburgh • Portland, Ore. • St. Louis • San Francisco • Seattle • Tulsa**

Here is CORROSION RESISTANT ALLOY VALVE DATA
that will help you Maintain Design and Production Schedules

● No matter how corrosive or abrasive your substance, there is a combination of alloys that *must* be used for efficient gate valve operation. To help you, this data is published in the interest of maintained production schedules and lower operation costs. It is available to design and maintenance engineers upon request.

General Guide to Materials for Various Services

Service	Major Parts	Trim	Pipe and Tubing
Acetic Acid	Ni-Resist, Copper	Special Bronzes, Stainless Monel, High Nickel Chromium	Copper, Monel, Aluminum
Acetone	Brass, Copper	Special Bronzes, Stainless	Copper
Air	Iron, Steel, Brass	" "	Iron, Steel, Brass, Copper
Alcohol	Iron, Steel, Brass, Copper	" "	" " "
Ammonia	Iron, Steel, Ni-Resist, Brass, Bronze, Stainless, Monel	" " "	" " "
Aniline Dyes	I… S…	Monel	
Beer		Stainless, Monel	" "
Brine			
Calcium Chloride			
Carbon Tetrachloride			
Carbonic Acid			
Calcium			

MATERIAL SPECIFICATIONS (METALS AND ALLOYS)

Darling Designation	Nearest A.S.T.M. Specifications	A.S.T.M. Specifications	Type or Name of Metal or Alloy	Form in Which Used	PHYSICAL PROPERTIES: Tensile Strength P.S.I.	Yield Point P.S.I.	Elong. in 2" %	Reduc. of Area %	Brinell Hardness	USES
Daraloy 437		B59-39 Grade A	Special Aluminum-Bronze	Castings	80,000	45,000	18		90	Valve stems, yoke stem nuts, disc facing, pressure castings, hydrant parts, seat rings, etc
Al.		B26-37	Aluminum	Castings	20,000	7,000	5			Valve parts for certain corrosive services.
		B89-40		Bar Stock	35,000	9,000	16	40		Valve stems for certain corrosive services.
…lar			Bolting Material, Regular	Headed Bolts or Studs	60,000	45,000	18	45		Ordinary service
		A96-39	Bolting Material,	Bolt Stud	125,000	105,000	16	50		High temperature and high pressure service.

For that CRITICAL INSTALLATION IN YOUR PLANT

To properly serve users of corrosion resistant valves, Darling Valve & Manufacturing Co. has developed a questionnaire to survey *all conditions* surrounding corrosion problems. Wire or write for your copy of this questionnaire. There is no obligation.

RATED SERVICE PRESSURES FOR ALLOY VALVES
WHEN MADE OVER IRON BODY, U-BOLT, BRONZE OR SPECIALLOY PATTERNS

USE OF CHART

Example—Assume that a 6-inch gate valve, made of Monel and suitable for 150 lbs. cold service pressure is needed. Monel is in Alloy Group C. Under 6-inch valves you find that a Group C valve to meet your needs can be obtained in the 125 lb. Steam, Iron Body pattern, the 150 lb. Steam, Bronze pattern, and the Specialloy pattern.
NOTE—Pressures shown in chart are the same for all sizes of valves in same shaded area.

ALLOY GROUP
A—Darvaliron, Darling 3, 146, and 180 Alloys.
B—Darling 137 Alloy Body and Bonnet, and 437 Alloy Discs.
C—Monel, Darling 96, 97, 302, 410 and 437 Alloys.
D—Aluminum.

Pattern	Regular Rating	Page No.	Alloy Group	SIZE OF VALVE, in Inches: ¼	⅜	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
				Alloy Rated Service Pressures in lbs. per sq. in. at 100° F.															
IRON BODY GATE VALVES	25 lb. Steam		A B C D											50 125 125 40		50 125 125 40		50 125 125* 40	50 125 125* —
	125 lb. Steam		A B C D											150 200 200 100		150 200 200* 100		150 200 200* —	150 200 200* —
	175 lb. O-W-G		A B C D											175 250 250 100		175 250 250* 100		175 250 250* —	175 250 250* —
	200 lb. O-W-G		A B C D											200 300 300 100		200 300 300* 100		200 300 300* —	200 300 300* —

TRADE DARLING MARK

VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

STURDY IN EVERY PART

Look at any Kennedy Valve in your dealer's stock . . . notice the generous proportions of body, stem, flanges, bolts and hand-wheel. If you take a Kennedy Valve apart, you will find similarly substantial stem-operating mechanism and stem contact threads. The entire valve looks sturdy and is sturdy. You are always safe when you buy Kennedy Valves, whether gate, globe, angle or check types in iron body or bronze.

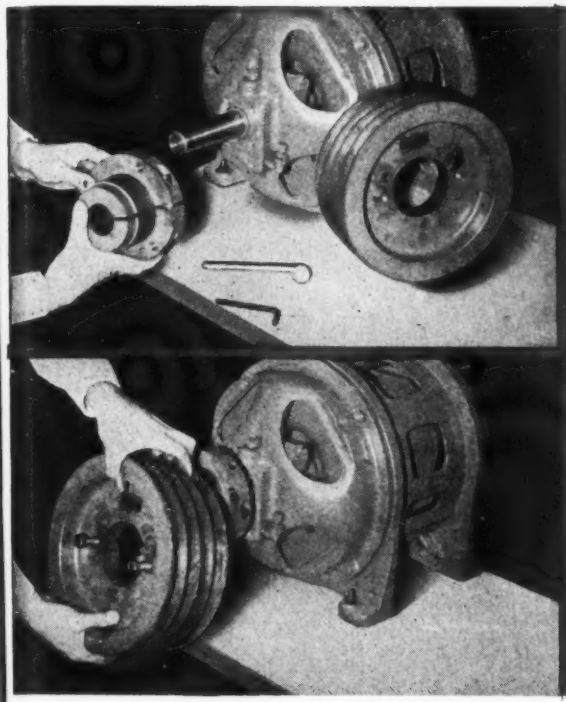
THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

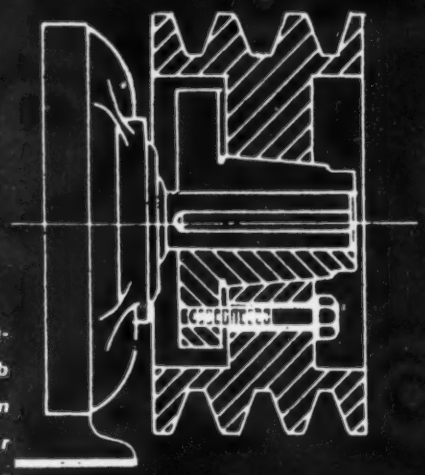
Fig. 57—Kennedy Standard Iron Body Gate Valve with Double Discs.

Kennedy Iron Body Gate Valves are also built with solid wedge disc, and in all sizes for steam pressures up to 250-lb. and for water pressures up to 500-lb.

KENNEDY *valves . . . pipe fittings . . . fire hydrants*

NO OTHER SHEAVE HAS THESE 3 ADVANTAGES





Split hub makes installation easy. Hub stays put—only rim is changed. Bigger pull-up bolts—higher taper cone pressure.

Worthington's QD Sheave is easy to get on, easy to get off, yet always tight on the shaft

If you have ever been in the shop when old-fashioned sheaves were being changed . . . saw workmen sledging and prying and sweating to get one off and another on . . . got an earful of loose fits, tight fits, misalignment, then you'll appreciate these advantages of Worthington's QD sheaves.

With the QD, the hub stays put, because a variety of sizes of rims fit it. When changes are made for different speeds, the rim is easily removed and replaced. On all other sheaves, the hub has to be loosened, presenting a realignment problem when the hub is drawn up to the rim. Once you put on the hub of the QD sheave, alignment problems are permanently solved.

These advantages, plus those of the Worthington-Goodyear Endless Cord V-Belts, make the Worthington Multi-V-Drive the most trouble-free method of driving by V-belts.

Stock size sheaves and belts are available at strategic centers throughout the country.

SELECT A MULTI-V-DRIVE THE WORTHINGTON WAY with this simplified, easy to handle Master Manual

You can select the right drive to fit your job exactly in three minutes by the watch—using just plain everyday arithmetic.

Scientifically evaluated, after years of laboratory tests, all factors affecting V-Belt life and V-Belt efficiency were taken into consideration so that each selection is guaranteed to give peak performance under all conditions for which it is recommended.

This 72 page indexed manual does your Multi-V-Drive engineering for you. Be sure to get your personal copy.

Mail in the coupon below now.

MV4-11

WORTHINGTON PUMP AND MACHINERY CORPORATION
Standard Products Div.
Harrison, N. J.

Centrifugal Pumps | Rotary Pumps | Steam & Power Pumps | Vertical & Horizontal Compressors | Liquid Meters | Variable Speed Drives | Multi-V-Drives

WORTHINGTON BEHIND THE NAME

Standard Products Division
Worthington Pump and Machinery Corporation
Harrison, N. J.

Please send me a copy of the Worthington Master Manual.

Name.....

Company.....

Address.....

Handle bigger loads with Steam you save

Any machine using steam at process pressures (5 to 150 lbs. per sq. in.) can give maximum efficiency only when both air and condensation are continuously and thoroughly ejected from the steam chamber of each unit.

The Webster Series "78" Trap assures automatic, prompt and continuous discharge of air and condensation from *each* steam-using machine. No loss of "live" steam in the returns. No air-binding or water-logging of equipment. Every pound of steam works full time.

Webster Engineers recommend an individual "78" Trap for *each* steam-using unit instead of the old-fashioned master-trap arrangement... And the cost of the traps themselves is soon returned through your savings in steam and time. You're assured of reduced heating-up time, increased daily output, and lower processing costs.

Find out about Webster Series "78" Traps today and how they can step up production for you. Your nearest Webster Representative is ready to help you determine how to correct your troubles. Look for his name in your local telephone directory or write us direct for Bulletin B-1200E. Address Dept. P-8.

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating :: Est. 1888
Representatives in principal cities :: Darling Bros., Ltd., Montreal

STEAM TRAP SELECTOR

Name of Machine	Number and Size of Traps for Steam Pressures up to 150 lbs.
Flat Work Ironer—2 Roll	2—½" Model 782 Traps
Flat Work Ironer—4 Roll	4—½" Model 782 Traps
Flat Work Ironer—6 Roll	6—½" Model 782 Traps
Flat Work Ironer—8 Roll	8—½" Model 782 Traps
Drying Tumblers with 2 Heating Coils	2—¾" Model 783 Traps or 2— 1" Model 784 Traps as required by size of machine
Small Presses for Collars, Cuffs, etc.	1—½" Model 782 Trap

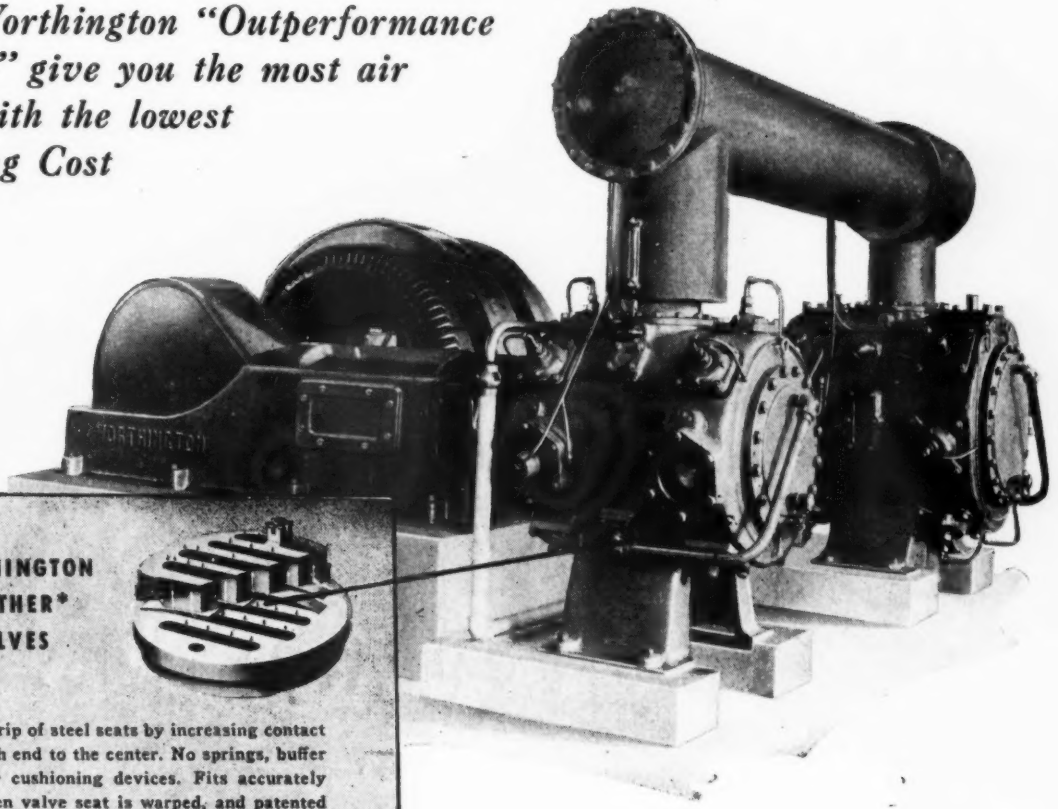
ARMY E NAVY

Webster Steam Heating

Webster Dirt Strainers placed ahead of Webster Traps protect Process Equipment against pipe scale, dirt and sediment. Basket easily removed for cleaning.

"SO MUCH — FOR SO LONG — FOR SO LITTLE"

Three Worthington "Outperformance Features" give you the most air power with the lowest Operating Cost



WORTHINGTON FEATHER* VALVES

A thin strip of steel seats by increasing contact from each end to the center. No springs, buffer plates or cushioning devices. Fits accurately even when valve seat is warped, and patented end inserts prevent pinching.

*Reg. U. S. Pat. Off.

Engineers, superintendents, maintenance men, who have watched Worthington compressors deliver dependable air power for a quarter century or more, know that few other compressors provide "so much, for so long, for so little."

There are three reasons:

1. WORTHINGTON FEATHER* VALVES, simplest, lightest, most efficient valves ever developed for air compression, reduce air friction, power consumption and cost of maintenance.

2. WORTHINGTON VARIABLE CAPACITY CONTROL, the most modern, simple, flexible control that money can buy, accurately, automatically, regulates pressure on a varying demand, insuring economy of power at partial capacities and lower operating temperatures, cooler cylinders, less cylinder maintenance.

3. WORTHINGTON-ENGINEERED INTERCOOLERS, designed for maximum cooling with minimum water, make possible the high efficiency of Worthington 2-stage compression, precipitating entrained moisture and saving power and maintenance costs through cooler operation.

For other "outperformance features" of the Worthington Type DC Feather Valve Compressors shown above . . . horizontal duplex motor-driven, direct-connected and belted, 75 to 3000 hp. . . . write for Bulletin L-675-B1.

A Worthington engineer is ready to analyze your application or installation problem, recommending methods and equipment. Write us. The Worthington Pump and Machinery Corporation, Harrison, N. J.

WORTHINGTON *BEHIND THE NAME* **WORTHINGTON**

AC4-7

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

Y-Type . . . Horizontal . . . Vertical . . . Radial . . . Portable . . . Gas Engine Compressors . . . Vacuum Pumps

Accordion action

Ring Controlled "PACKLESS" EXPANSION JOINTS

Even the most contrary pipe line responds amiably when you install Ring Controlled Packless Expansion Joints made by Badger Fire Extinguisher Company. Joint tight and requiring no packing, they provide perfect automatic compensation for every variation in temperature and pressure and for all vibration or axial movement.

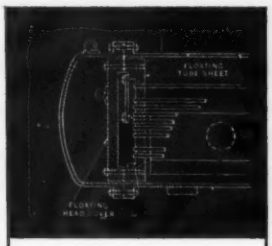
Ring Controlled Packless Expansion Joints as made by Badger Fire Extinguisher Company are especially processed to eliminate stress and strain in the metal. Made with single or multiple corrugations, in flange or weld types, and in copper, stainless steel or other alloys to fit your particular needs for steam, air, liquid or gas lines.

In the May 1944 issue of POWER on page 269, an advertisement was inserted by this Company which by its setup and text, may have created an impression that the Ring Controlled Expansion Joints advertised were Badger Expansion Joints manufactured by E. B. Badger & Sons Company. The use of the word "Badger" in connection with ring controlled packless expansion joints in such advertisement was an unintentional interference with the rights of E. B. Badger & Sons Company which has the sole right to use the name "Badger Expansion Joints." The Badger Fire Extinguisher Company wish to correct any such erroneous impression and to state that Ring Controlled Expansion Joints advertised by it are manufactured by Badger Fire Extinguisher Company which has no connection with E. B. Badger & Sons Company.

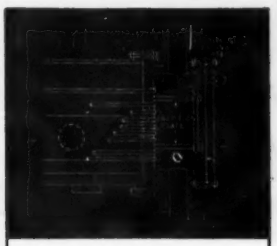
BADGER FIRE EXTINGUISHER COMPANY, *Somerville, Mass.*

6 REASONS why G-R STAGE HEATERS assure BEST RESULTS

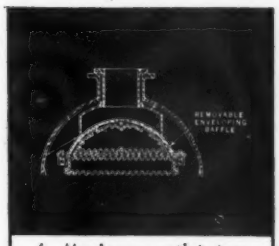
1. Minimum high-pressure joints . . . patented "Stationary Heads" and "U-tube" designs specially developed for high-pressure service.



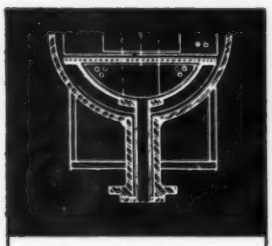
2. Joints easy to reach and keep tight without requiring handling of heavy parts.



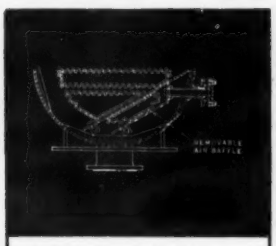
3. Internal leakage prevented . . . patented G-R partition sealing plates eliminate staybolts and prevent leakage between passes.



4. Maximum outlet temperature . . . the efficient G-R enveloping desuperheating zone is used for water temperatures exceeding the saturated steam temperature.



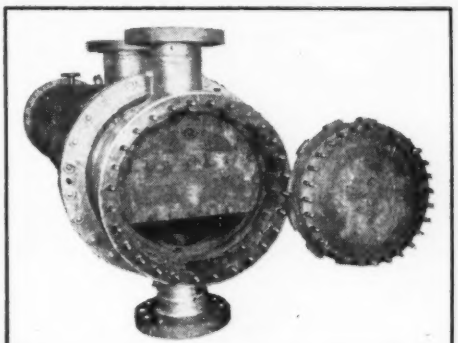
5. Subcooling of drains . . . before leaving the heater shell, the drains pass through the G-R subcooling zone.



6. Effective air baffling . . . provided by removable baffle.

The ideal stage or extraction heater is one which provides greatest heating effectiveness from the available steam, together with fewest joints subjected to pressure and lasting tightness of such joints.

Griscom-Russell has been building heaters to meet these requirements for three-quarters of a century. Some of the exclusive provisions which accomplish these objectives in G-R stage heater designs for high pressure service are illustrated above. These details, together with complete description of the many types of G-R Stage Heaters, are more fully explained in Bulletin 277, which will be sent on request.



Head and cover used in the G-R high-pressure Type L "Breech Block" design of Stage Heater, showing the projections which carry the hydraulic load and thereby eliminate the necessity for heavy bolts. This design has the additional advantage of an external gasketed joint which is accessible without disturbing the head cover. The cover is readily removed from the head or replaced.

THE GRISCOM-RUSSELL CO.
285 Madison Ave. New York 17, N. Y.

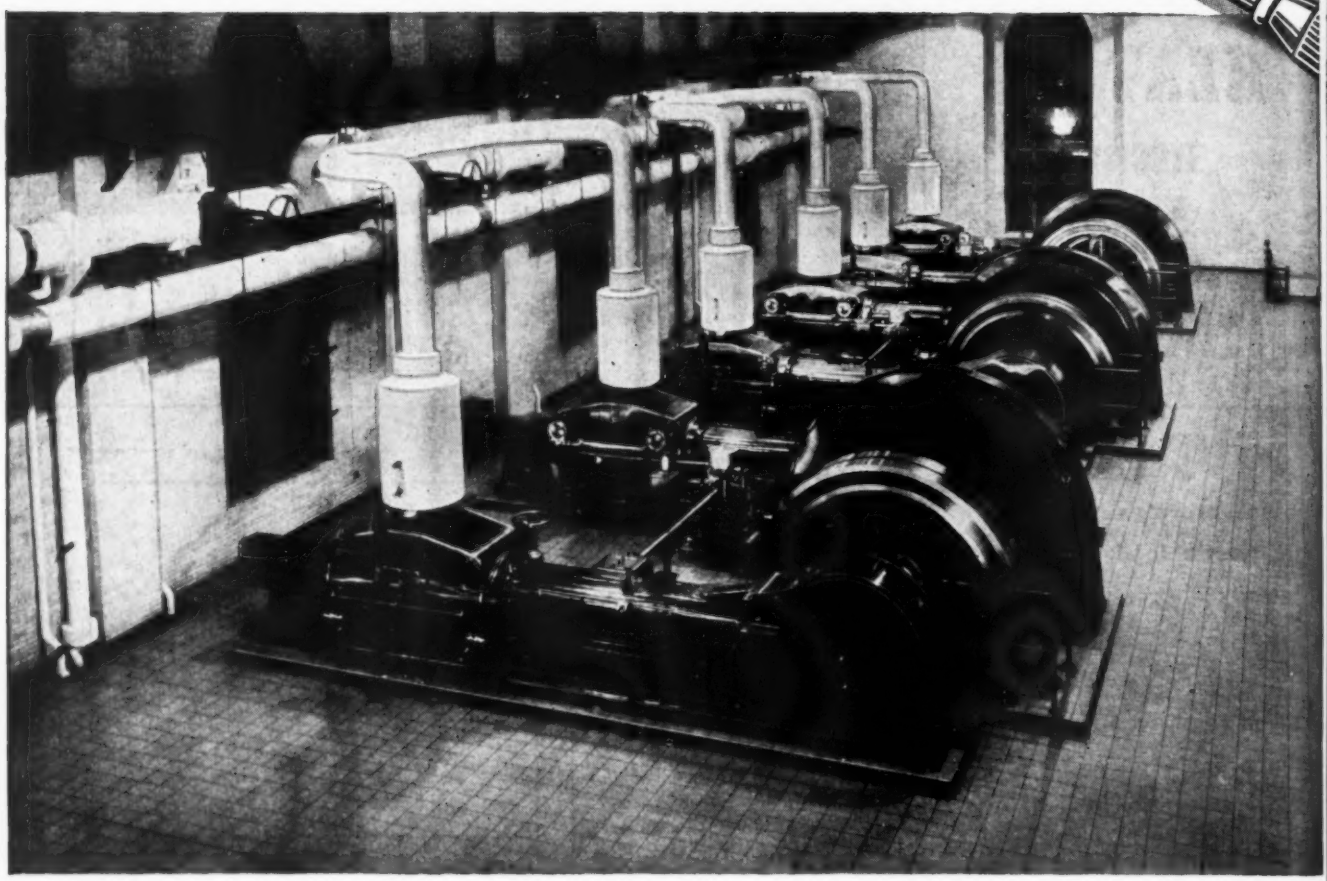
GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

Correct Lubrication

MEANS

BETTER MAINTENANCE



• Very often, *correct* lubrication is the remedy for difficult maintenance due to excessive wear.

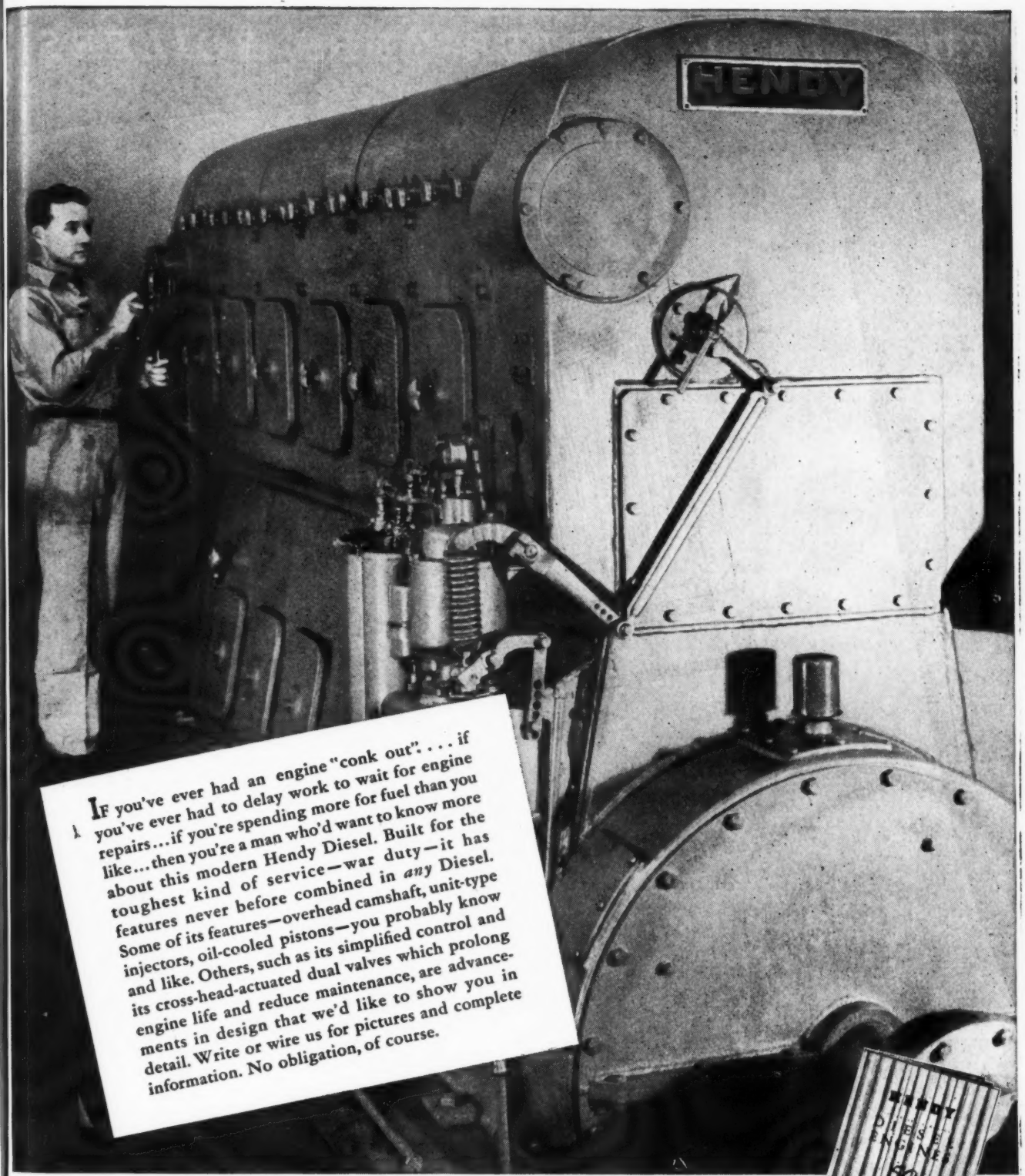
For *correct* lubrication of *STEAM ENGINES* Sinclair provides Steam Cylinder and Valve Oils that satisfy all combinations of temperature, pressure, speed, and moisture conditions . . . that suit all engine designs and operating conditions.

• • •

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.



IF you've ever had an engine "conk out"... if you've ever had to delay work to wait for engine repairs... if you're spending more for fuel than you like... then you're a man who'd want to know more about this modern Hendy Diesel. Built for the toughest kind of service—war duty—it has features never before combined in *any* Diesel. Some of its features—overhead camshaft, unit-type injectors, oil-cooled pistons—you probably know and like. Others, such as its simplified control and its cross-head-actuated dual valves which prolong engine life and reduce maintenance, are advancements in design that we'd like to show you in detail. Write or wire us for pictures and complete information. No obligation, of course.

JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

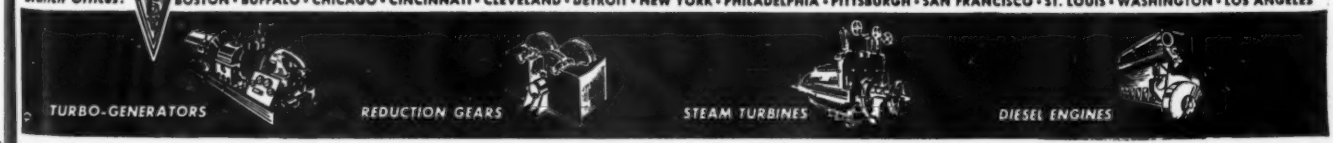
SUNNYVALE, CALIFORNIA

Specifications—6 and 8 cylinders; 4-stroke cycle; 12" bore; 15" stroke; 350-675 hp.

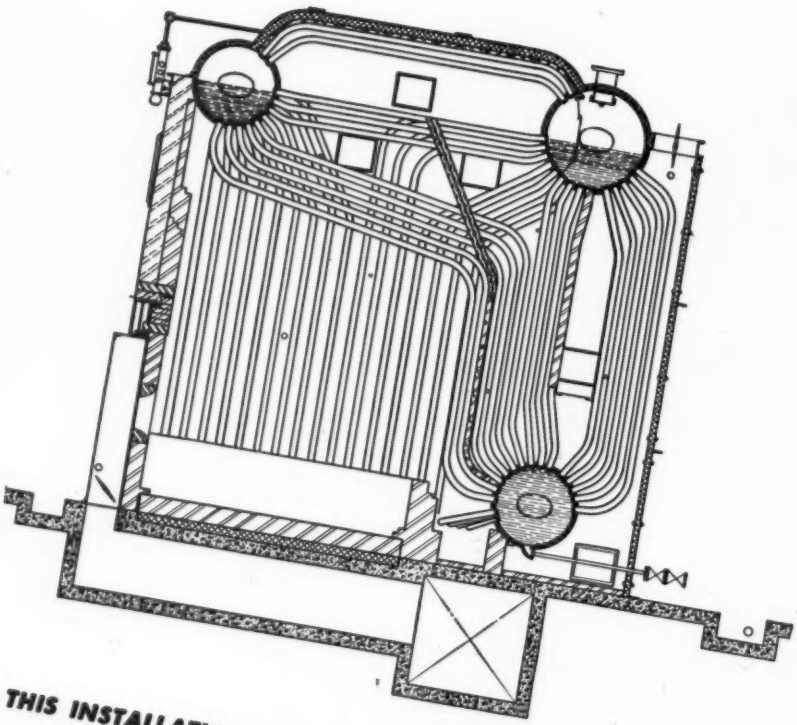
39-V

EST. 1856

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES



EDGE MOOR WATER TUBE BOILERS



THIS INSTALLATION: 2 units; 3-drum, bent tube, with water walls; oil fired.

CAPACITY . . . . . 35,000 lbs. steam per hour

DRUM PRESSURE . . . . . 200 lbs.

FINAL STEAM TEMPERATURE . . . 385° F.

A medium size unit of high efficiency with a long record of trouble-free operation.

● Edge Moor Boilers are designed for any required capacity and up to 900 lbs. drum pressure. Complete steam generating units are available, including boilers, superheaters, water walls, economizers and air preheaters.

STEAM GENERATING EQUIPMENT

EDGE MOOR

BRANCH OFFICES: NEW YORK 20, N. Y., 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL., ONE NORTH LA SALLE STREET

MAIN OFFICE: EDGE MOOR, DELAWARE

scale-free boiler tubes start in a test tube

"The first step in efficient operation is a "properly conditioned boiler water." The Dearborn Service Engineer in your district knows how to get it. He can talk with you about the specific problems in connection with your local water supply.

The results of the complete laboratory findings go to our chief chemical engineer, who works out a formula to fit your conditions and recommends the amount of chemicals to be used together with suggested methods of application. This is transmitted to you direct—or through the Dearborn Service Engineer.

Testing Cabinet

A wide range of complete testing equipment is available for plants of all sizes and various requirements.

...recommended conditions are maintained by checking with this Testing Cabinet in your own plant

When recommendations are adopted by your plant, continuous control of boiler water can be maintained with the Dearborn Testing Cabinet —designed for use in your own plant to test boiler water samples.

Report blanks keep contact between us, and all control tests are under the constant direction and supervision of Dearborn's Chief Technical Engineer, whose experience covers boiler water conditions in all size steam producing plants in every state in the union.

Call for the Dearborn Service Engineer in your district to give you complete details on how to get that "properly conditioned boiler water."

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

1944

Horsepower and Horse Sense *Go together*

"On my seventeenth birthday, George, I got a wood turning lathe for Christmas. Well, sir; I was fascinated by all the curlycues I could turn out and, for some time, everything I made was jam-packed with curves, grooves, flutes and spirals."

"I did the same thing with a jig saw, Boss."

"Sure—but sooner or later experience and horse sense tells you that simplicity in design is the big thing, whether it's in art, architecture or machinery. These engines have given Busch-Sulzer a great reputation, because of the way they perform—and the secret of their performance is simplicity."

* * *

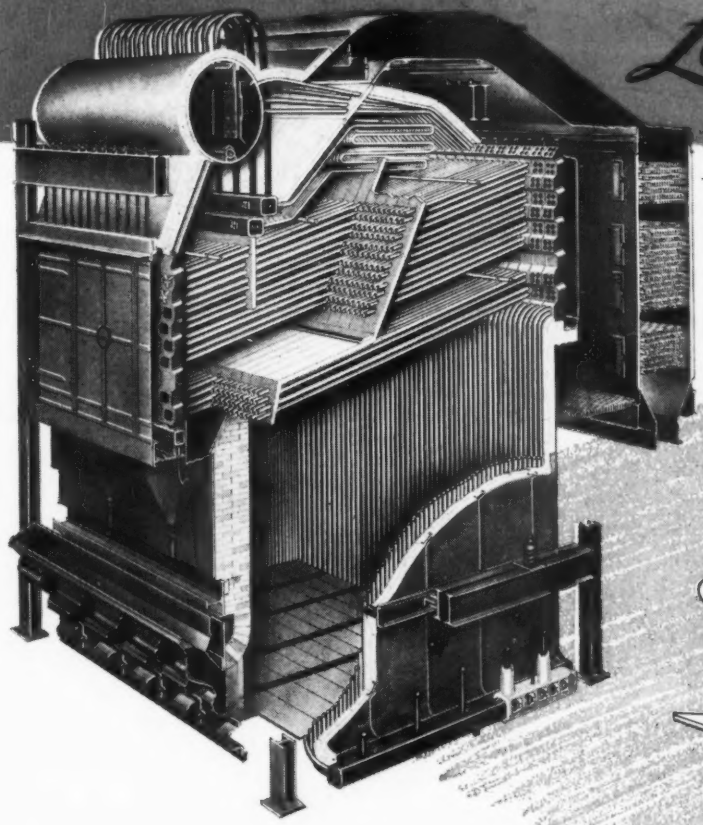
Busch-Sulzer's constant striving for simplicity is best demonstrated in its perfection of a design for trunk pistons in the larger Diesels more than a dozen years ago. Thus, the many parts of the crosshead type are no longer necessary. The innovation was greeted with skepticism, but years of performance have proved the wisdom of the change. We build Diesels for marine and stationary use in both 2-cycle and 4-cycle types. Horsepower per unit up to 7500. An inquiry on your letterhead will receive prompt attention.

BUSCH-SULZER BROS.–DIESEL ENGINE COMPANY • SAINT LOUIS

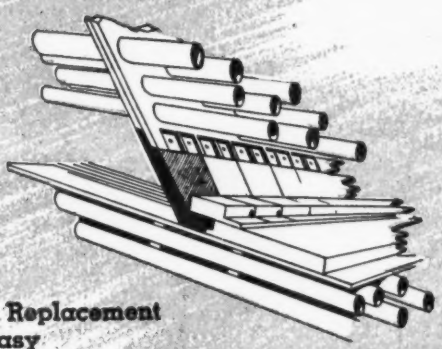
AMERICA'S OLDEST BUILDER OF DIESEL ENGINES

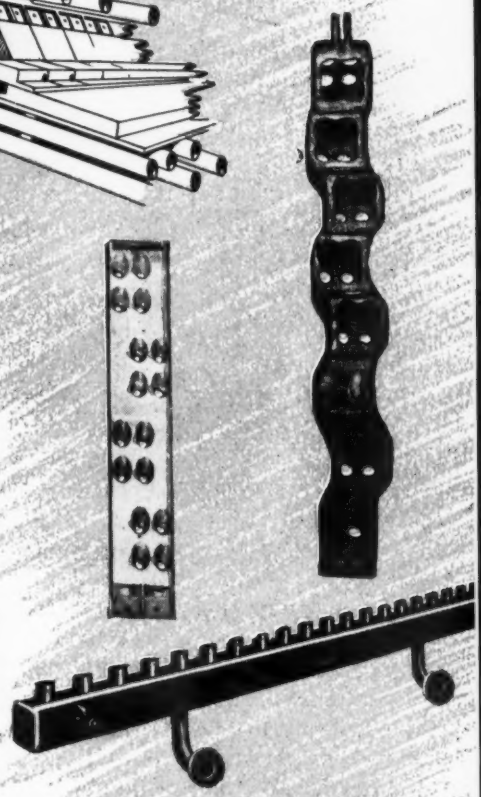
BUSCH-SULZER
ST. LOUIS

Springfield features that insure *Longer* BOILER *Life*



OUT of Springfield's 55 years of experience in designing and building various types of boilers have come many improvements which prolong boiler life and maintain efficiency.





Corrosion-Free Mud Drum

Nowhere in the boiler is the corrosion-free quality of cast electric steel so important in reducing maintenance as in the mud drum. No mud drum on a Springfield boiler has had to be replaced since Springfield changed from wrought steel to cast steel mud drums more than 10 years ago!

Cast Electric Steel Headers

Casting plus full annealing provides a steel header which is free from seams or crevices to start corrosion or embrittlement. Casting provides a material which has both high tensile strength and ductility without being "soft"—the best combination to insure stronger, permanent, rolled connections.

Permanently Tight Baffles

Sectional baffles of rugged construction designed to take full advantage of the cooling effect of the boiler tubes are another Springfield feature insuring lower maintenance and longer life. Joints between baffle sections are reduced to a minimum and are all offset sealed.

Where the baffle wall is exposed to high temperature, such as the junction between horizontal baffle and first pass baffle in the above illustration, easily renewable sections are provided.

20 years and more of service without maintenance is a common occurence with Springfield baffles.

Tube Cleaning or Replacement Made Easy

Tube cleaning is simple with a Springfield boiler and any tube may be replaced without disturbing the baffles or any other parts of the boiler. This maintenance operation is made easy by two Springfield details. Holes in the baffle wall are metal lined and are belled to make tube replacement easy. Four-tube handhole openings provide maximum accessibility. Easier maintenance insures better maintenance and longer life.

Shop Assembly and Testing

Using the best factory tools and equipment, skilled specialists at the factory assemble sections more accurately and test them more carefully than can be done in the field. Springfield water walls as well as boilers are shop assembled in sections when possible.

Other Springfield Features

Springfield design as well as construction incorporates the best features of modern boiler practice. Small diameter tubes, staggered to insure gas contact, scientifically baffled cross drum, "tailored" water walls, superheaters, and economizers all combine to provide a modern, quick-steaming boiler, easy to operate, easy to maintain, low in operating cost, high in operating efficiency. Send for the complete Springfield story. Write today.

SPRINGFIELD BOILER COMPANY
1953 E. Capitol Ave., Springfield, Ill.

SPRINGFIELD

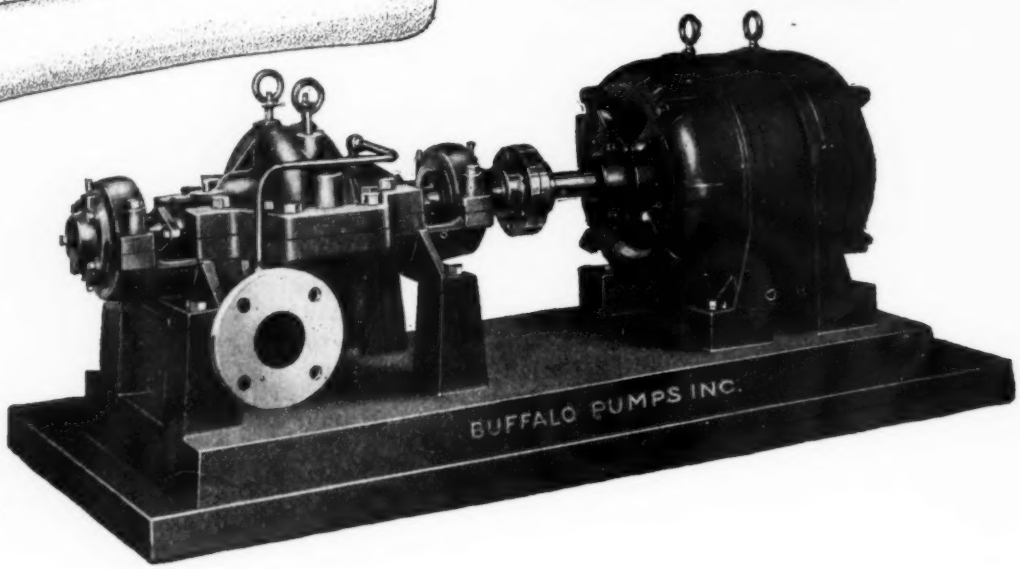
STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

GOOD DESIGN

TAKES IMAGINATION *Plus* EXPERIENCE



Imagination to find a way out of mechanical difficulties—experience to know whether the solution is practical.

The design of the Buffalo "RR" Pump called for a decided departure from previous practice—but results justified it. These pumps are giving excellent performance on boiler feed and other clear water service. Their rugged construction means low maintenance cost, initial high efficiency is maintained in service.

Write for Bulletin No. 980-A which gives complete details.

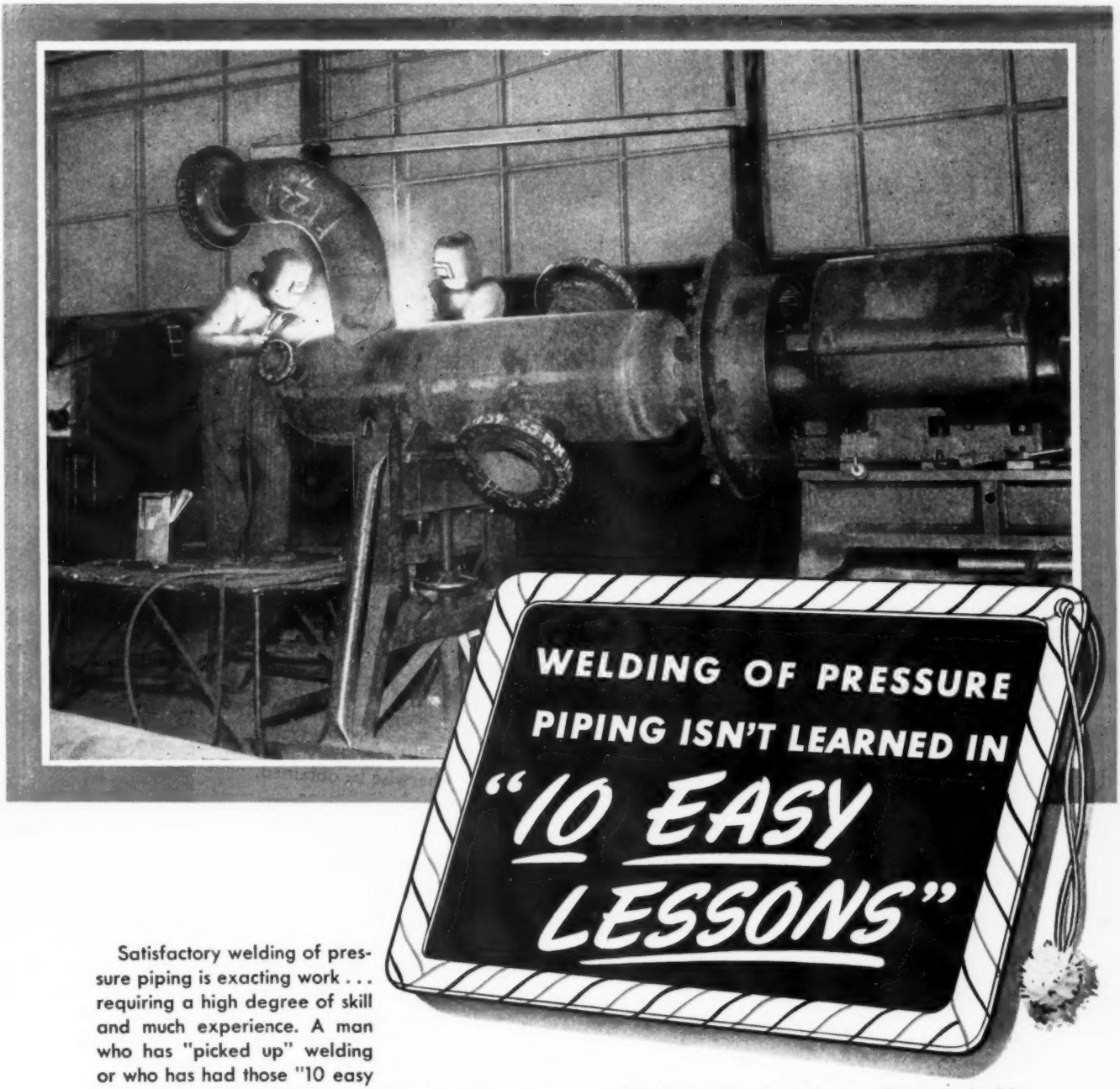
BUFFALO PUMPS, INC.

488 Broadway Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

ARMY E NAVY

"Buffalo" CLASS RR PUMPS



Satisfactory welding of pressure piping is exacting work . . . requiring a high degree of skill and much experience. A man who has "picked up" welding or who has had those "10 easy lessons" cannot be expected to do pressure piping work that will pass inspection.

Welders employed by pipe fabricators are carefully trained and have plenty of experience before they are entrusted with pressure work. They have passed operator qualification tests and use procedures that have been qualified. They work with the best equipment . . . special rotating fixtures enable them to weld under the most favorable conditions. Their work is also regularly checked by laboratory tests.

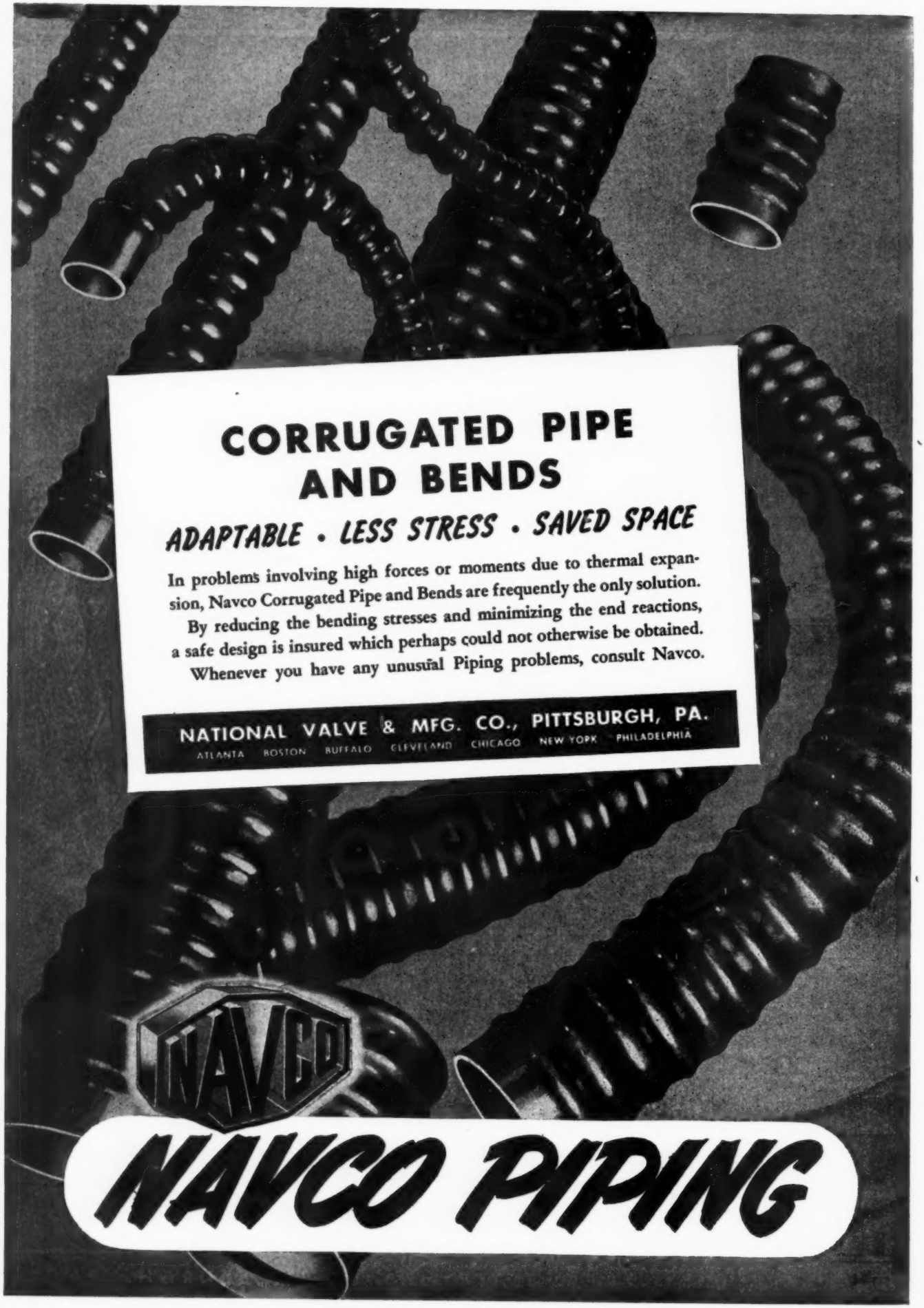
Pre-fabricated piping comes to you in a series of subassemblies with all difficult operations performed. These subassemblies are commercially practical, heat treated and stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Erection requires a minimum of time and labor; the finished job is better piping.

THE PIPE FABRICATION INSTITUTE

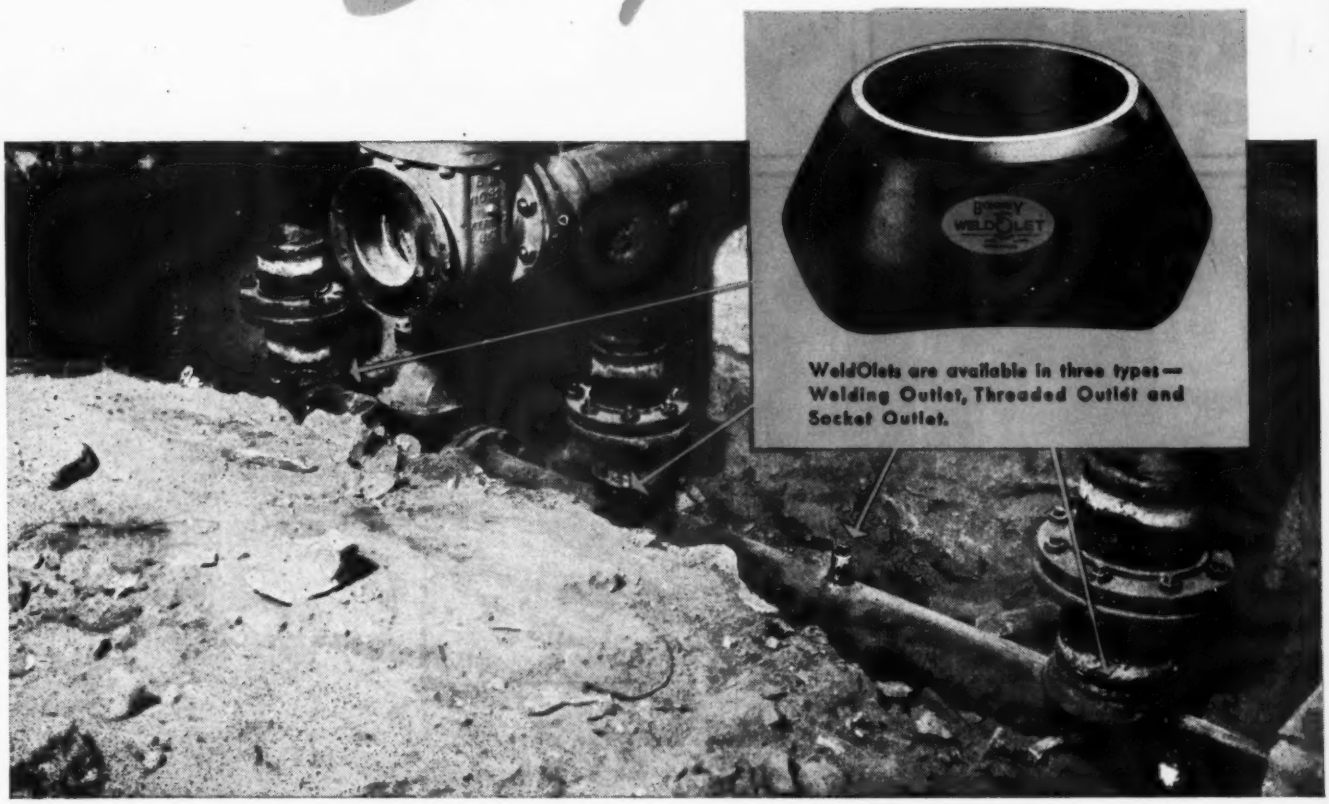
Devoted to the Technical and Economic Problems in Piping

P-S

1108 CLARK BUILDING • PITTSBURGH, PA.


CORRUGATED PIPE
AND BENDS
ADAPTABLE • LESS STRESS • SAVED SPACE
In problems involving high forces or moments due to thermal expansion, Navco Corrugated Pipe and Bends are frequently the only solution.
By reducing the bending stresses and minimizing the end reactions, a safe design is insured which perhaps could not otherwise be obtained.
Whenever you have any unusual Piping problems, consult Navco.
NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.
ATLANTA BOSTON BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA
NAVCO
NAVCO PIPING

Difficult Branch Pipe Jobs made *Easy* by WeldOlets



WeldOlets are available in three types—Welding Outlet, Threaded Outlet and Socket Outlet.

If you have to make difficult branch pipe connections like these, it takes time and costs money. The WeldOlet method makes possible the installation of branch pipe outlets such as those illustrated above without removing the main pipe from the line.

A WeldOlet of the proper type is positioned on the pipe, tacked and welded in place before or after cutting the hole in the run pipe. The inside of the weld can then be inspected before the branch pipe is connected.

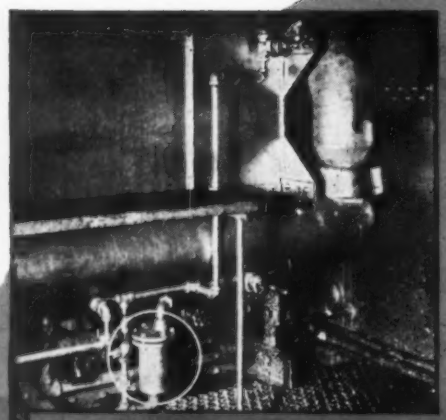
The result is a branch pipe outlet that insures full pipe strength. Flow through the pipe is smooth, with a minimum of friction and turbulence because of the funnel shaped opening in the fitting; freedom from weld icicles that might restrict flow; and maintenance of full inside pipe diameter.

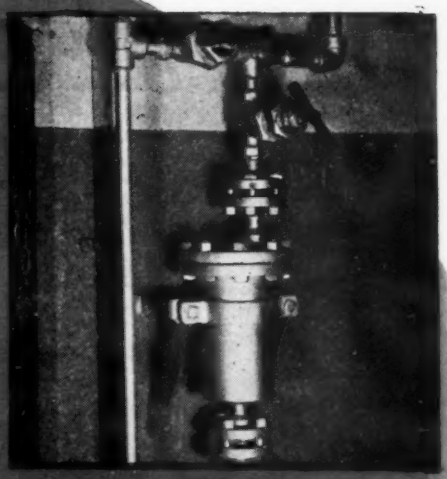
WeldOlets have no equal for ease of installation on the really tough branch pipe jobs. The strength and rigidity that they give a piping system plus their highly efficient flow conditions justify their use wherever a branch pipe outlet is made.

WeldOlets are recommended for pressure values up to 400# steam pressure at 750° F. Size-to-size and reducing sizes are available from ¼" to 24". For complete information on types and sizes send for Bulletin WT31.

Forged Fittings Division • **BONNEY FORGE & TOOL WORKS** • ***342 Green St., Allentown, Pa.***

WELDOLETS
TRADE MARK REG. U. S. PAT. OFF.
PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets





● *The photographs show an exterior view of one of the many Armstrong-equipped central stations . . . applications of Armstrong high pressure traps in power plant and marine service . . . and an Armstrong compound trap draining steam header in a municipal plant.*

The diagram: trap hookup providing protection for pressure reducing valve and desuperheater on high pressure steam line.

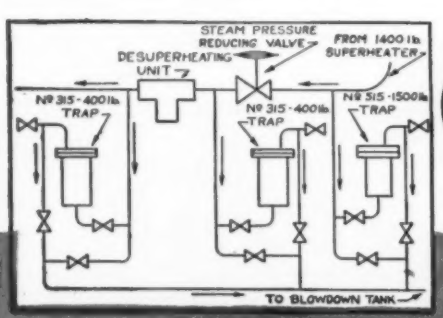
Armstrong *Inverted Bucket* TRAPS Standard for High Pressure Service

Way back in 1911 a boiler pressure of 125 lbs. was considered really "high pressure". And steam traps had developed no farther than these "high pressure" boilers. In that same year Armstrong built the first inverted bucket trap that sounded the death knell to such practically obsolete contraptions as pet cocks to prevent air binding and drain connections to get rid of sediment and sludge. For the first time engineers could install traps that were non air binding and self scrubbing — could install traps and forget them.

The rise in boiler pressures which began after World War I was paralleled by material and design improvements in the Armstrong Trap. To name a few: heat treated chrome steel valve parts replaced brass and bronze, steel forgings replaced castings, stainless steel buckets replaced brass. A frictionless leverage system replaced the original leverage design which took power to operate and time and money to maintain.

Because of these and other improvements, the Armstrong Traps are as modern as the high pressure boilers with which they are used. This is why so many high pressure Armstrong traps are in service and why the words Armstrong and steam trap are synonymous to power plant engineers.

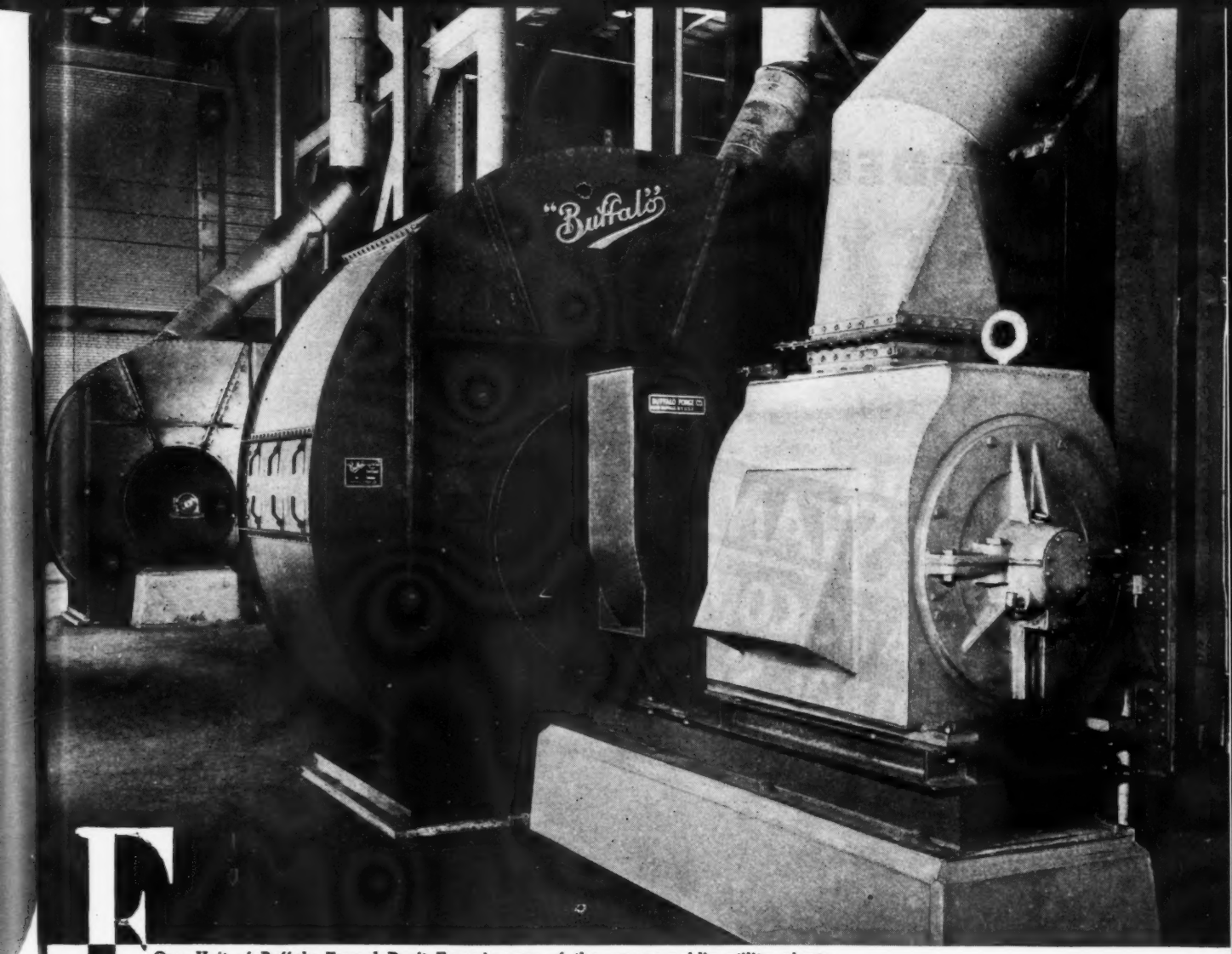
The Armstrong Steam Trap Book goes into detail as to design and contains complete data for sizing and installing high pressure traps. A copy is yours for the asking. Just write Armstrong Machine Works, 814 Maple Street, Three Rivers, Michigan.


STEAM PRESSURE REDUCING VALVE
FROM 1400 lb. SUPERHEATER
DESUPERHEATING UNIT
№ 315 - 400 lb. TRAP
№ 315 - 400 lb. TRAP
№ 315 - 1500 lb. TRAP
TO BLOWDOWN TANK

ARMSTRONG STEAM TRAP

Armstrong

The Original Inverted Bucket Steam Trap



One Unit of Buffalo Forced Draft Fans in one of the newer public utility plants

Fan performance starts on paper

There is no doubt that power plant fans offer the toughest problem for the fan engineer. They operate under conditions which do not tolerate weaknesses. They operate on a twenty-four hour schedule—and an unexpected shut-down due to fan trouble can "raise Cain" with a plant or a community.

Fine draft fan performance starts on paper—in the engineering department of the manufacturer. Heavy-duty rotors, husky shafts, oversize bearings and accessible housings are all essential to this fine performance, but beyond all that there must be a continuous aim to improve the wearing qualities from a "field maintenance" viewpoint.

Frankly, we who have been in the fan business for sixty-six years get real pleasure out of our forced and induced draft fan business—a pleasure that extends out in the shop to the workmen who build the fans. For nearly every job that goes thru the plant has some new slight departure from the last one, an improvement here, a change there—so that always—Buffalo forced and induced draft fans are the best that experienced engineers and skilled workmen can produce.

BUFFALO FORGE COMPANY

488 Broadway Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Buffalo, N. Y.

ARMY E NAVY

"Buffalo" MECHANICAL DRAFT APPARATUS

ADDED "Skilled Hands" FOR YOUR BOILER ROOM

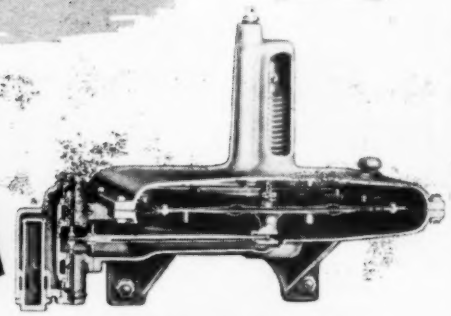
CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

To inaugurate and maintain a fuel saving program yet produce sufficient steam, whether you use coal, oil, or gas requires the utmost in skilled attendance. There can be no error—no neglect—no sleeping on the job.

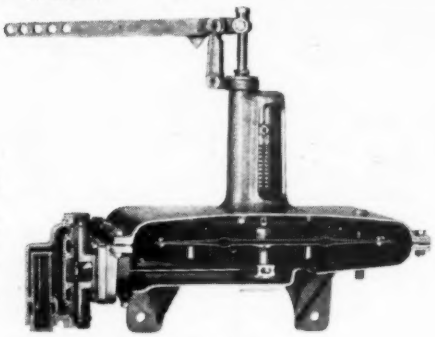
To install CASH STANDARD Automatic Combustion Control Systems is like adding "skilled hands" . . . but, with this control you get constant automatic attention to insure correct fuel feed, proper air supply, and a constant over-fire draft . . . there's never a slip . . . therefore, you very easily boost boiler output.

CASH STANDARD Units can be combined to make a most accurate and dependable Automatic Combustion Control System to meet any condition and work on any boiler with any kind of fuel.

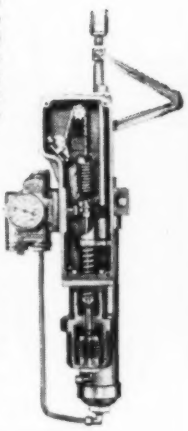
Write today for Bulletin No. 300



FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

Muscling In

ON ALL FRONTS!

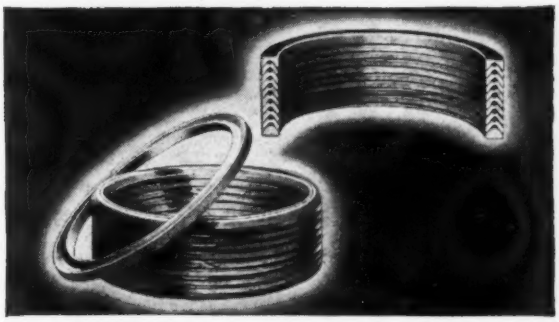
When a bulldozer lands on an invasion beach... or is flown behind enemy lines... it must be ready for instantaneous service—dependable in every individual part.

A hydraulic control system operates the earth-moving equipment. To accomplish this, oil, circulating at low pressure, is stepped up to tremendous force. On this depends the usefulness of the "dozer" as a fighting tool.

Hose and packing, developed by U.S. Rubber engineers are being used to safeguard the efficiency of pumps and jacks performing this all-important function. Wire-braided hose capable of withstanding extreme working pressures is used. The packing rings are automatic in action, responsive to pressure changes, and tested under temperatures ranging from —40° to 400° F.

SERVING THROUGH SCIENCE

HYDRAULIC CONTROL—Consists of pumps to create power, valves to direct it, a jack to apply it. U.S. Hose and Packing both utilizing synthetic rubber—impervious to destructive action of grease, oils, solvents and hydraulic fluids and capable of handling oil-pressures of enormous force—are provided.



U. S. MATCHLESS PACKING SETS—Are now being delivered in huge quantities to "dozer" manufacturers, Army Engineers, Seabees. Molded to accurate sizes; special top and bottom rings for square or bevel stuffing boxes.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

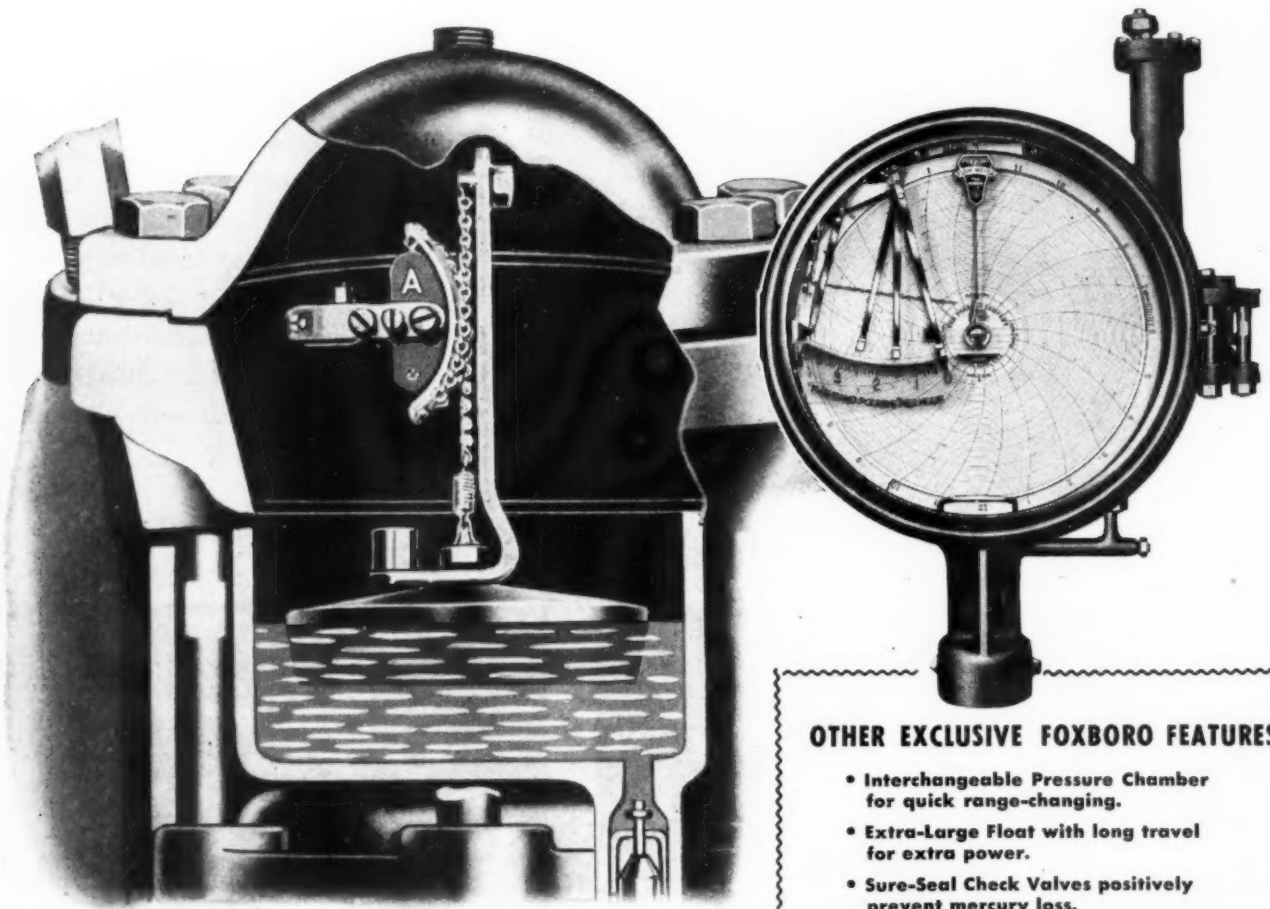
Yes... THERE IS A DIFFERENCE IN FLOW METERS!

The overall accuracy of any meter installation involves not only choosing a correct primary measuring device, but also an accurate, dependable differential recorder. Both demand the best in engineering.

For example, a typical, important Foxboro development is the patented Segment Transmission that gives straight-line calibration. It eliminates angularity errors of common levers and avoids excess friction and lost motion of rack-and-pinion movements. Slightest changes in mercury level due to flow-change are transmitted to the recording pen without error!

When you buy a Foxboro Meter, you get these extra values without extra cost . . . Maximum Accuracy – Dependability with Low Maintenance Cost – and correct engineering born out of thirty years of meter experience, including original research that has solved the most difficult metering problems. Recognition of this superior "know how" is indicated by industry's acceptance of Foxboro's, "Principles and Practice of Flow Meter Engineering", as the authoritative handbook.

Write for Bulletin 200-6 which describes recording, controlling and indicating Foxboro Meters for any service. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Massachusetts, U. S. A.**



The patented Foxboro Segment (A) produces straight-line calibration. The vertical motion of the float is transmitted through a unique, patented ladder-chain, giving positive transmission of the linear to rotary motion without variables. Functions like a rack-and-pinion, but without the friction and lost motion of gear teeth.

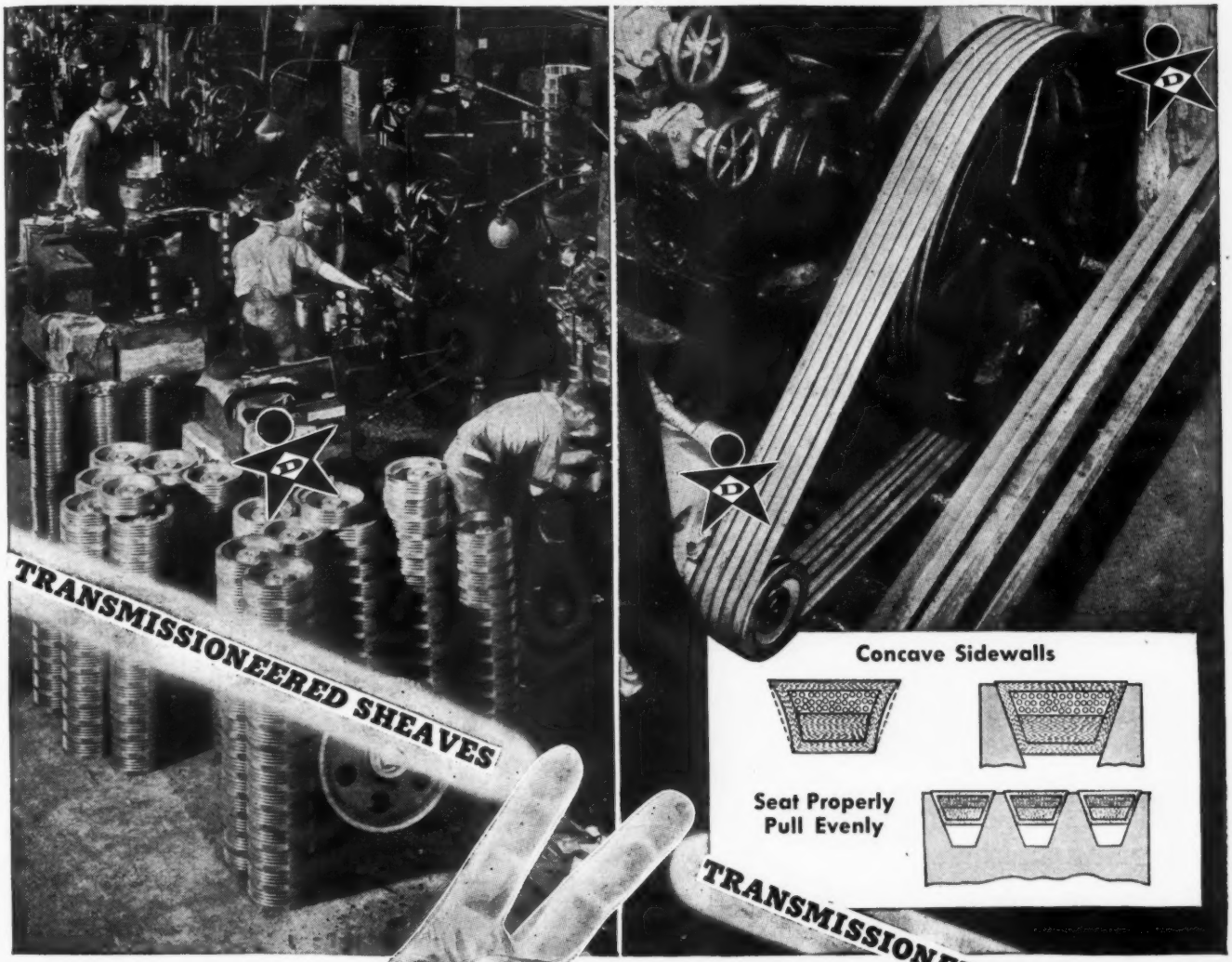
OTHER EXCLUSIVE FOXBORO FEATURES

- **Interchangeable Pressure Chamber for quick range-changing.**
- **Extra-Large Float with long travel for extra power.**
- **Sure-Seal Check Valves positively prevent mercury loss.**
- **Easy-Cleaning Float Chamber requires no disconnection of piping.**
- **Pressure-Tite Bearing eliminates stuffing box and packing.**

FOXBORO
REG. U. S. PAT. OFF.

MONEY-SAVING FLOW METERS

TRANSMISSIONEERED MEANS ADVANCED DESIGN IN POWER DRIVES



IT TAKES *Both* TO PUT *ALL* THE POWER IN THE JOB

It takes both DV Sheaves and DV Belts to make a Dodge Transmissioneered DV drive—the perfect team for delivering all of the power to the job.

Transmissioneered means advanced design in power drives. Translated into operating advantages of the DV drive it means: uniform seating of belts in grooves, even distribution of load—full contact of belt with grooves due to concave side walls—full transmission of power without loss—longer belt life—no adjustment or lubrication—minimum maintenance.

Transmissioneered

DODGE

DV DRIVES

Dodge Transmissioneered DV Drives are clean, silent and trouble-free . . . Call the Dodge Transmissioneer, your local Dodge distributor.

DODGE MANUFACTURING CORPORATION, Mishawaka, Ind.

The Sign of the Dodge Transmissioneer

No. 11

THE RIGHT DRIVE FOR EVERY JOB

No matter how involved your plant layout may be, here is the most efficient solution of your heating problem:

DIRECTHERM

UNIT HEATERS STOKER-FIRED

HEAT MORE SPACE AT LESS COST

LOW INITIAL COST	— Saves money the first day
SIMPLE INSTALLATION	— No duct work, radiators or pipes needed
LITTLE MAINTENANCE	— Automatic controls do the work
WIDE HEAT SPREAD	— Heat "fans" out 200 feet
SIX SIZES	— 300,000—1,700,000 BTU

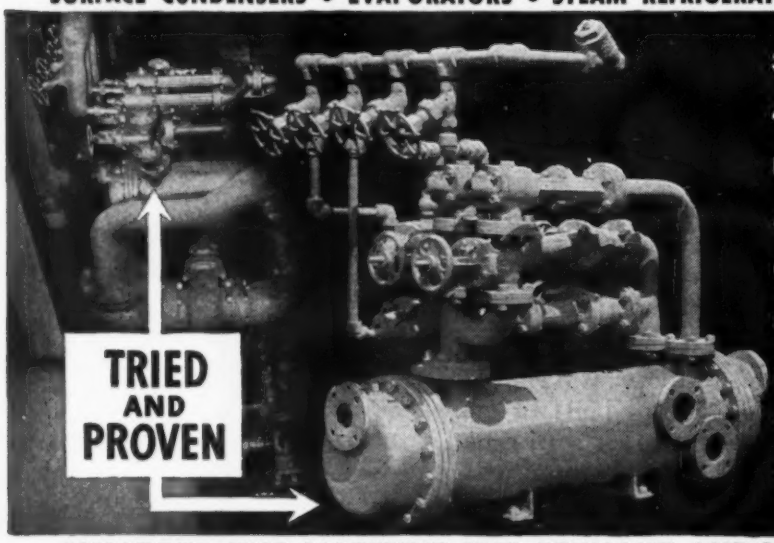
May we send you our descriptive bulletin?

AIRTHERM MANUFACTURING CO.

732 S. SPRING AVE ST LOUIS, Mo.

HIGH VACUUM

SURFACE CONDENSERS • EVAPORATORS • STEAM REFRIGERATION • LUBE OIL COOLERS • EXCHANGERS



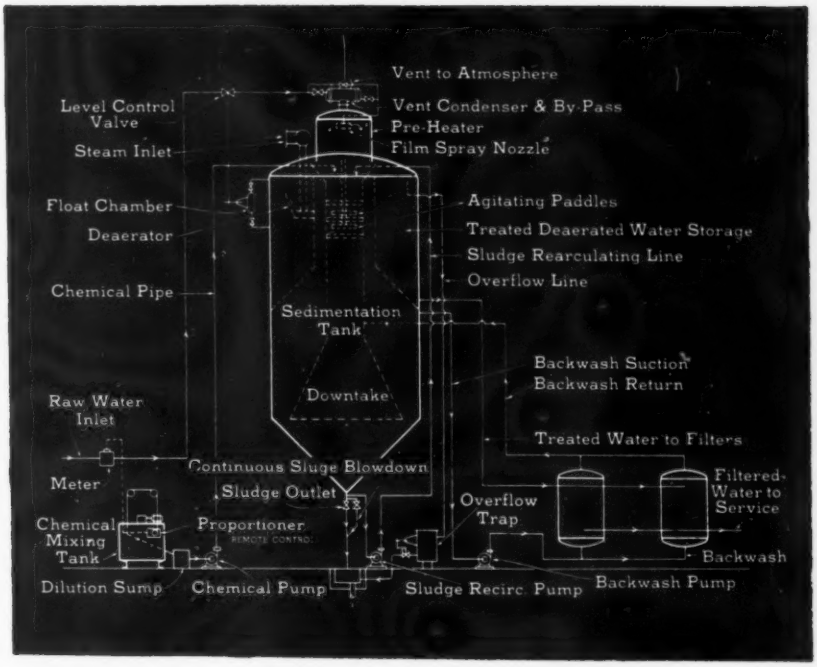
300 UNITS OF THIS DESIGN ALONE . . . . 400 OF ANOTHER . . . . AND MANY HUNDREDS OF OTHERS . . . . A GRAHAM STEAM JET EJECTOR HAS NEVER DELAYED . . . . COMPLETION OF A PROJECT . . . . THROUGH EITHER LATE DELIVERY . . . . OR FAULTY PERFORMANCE . . . . GRAHAM CAN OFFER YOU . . . . THE REAL SOLUTION . . . . TO YOUR VACUUM PROBLEM . . .

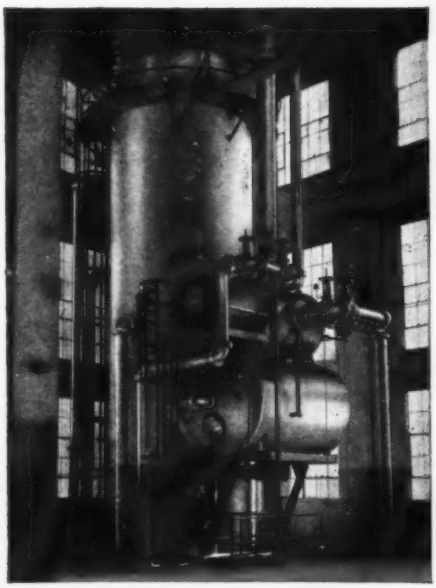
AWARDED THE MARITIME "M" PENNANT AND VICTORY FLEET FLAG APRIL 8, 1944

GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE • NEW YORK 17, N. Y.

It pays to go *all the way*





A Graver Deaerating Hot Process Water Softener with Condensate Conditioning Equipment installed in a large industrial plant.

The diagram at the top shows the Graver Deaerating Hot Process Water Softener with Condensate Conditioning Equipment. It can also be supplied without the condensate conditioning equipment, if desired.

in feed water treatment

For maximum operating efficiency, your boiler plant requires conditioning of *both raw water and condensate return*.

A Graver Combination Deaerating Hot Process Water Softener and Condensate Conditioning System will produce perfect boiler feed water regardless of ratio of raw water makeup to condensate return. You save three ways by going all the way.

FIRST **—you get a boiler water having maximum temperature and minimum hardness, and which is free from corrosive oxygen and carbon dioxide gases.**

SECOND **—you save on fuel, boiler maintenance, and loss of heat due to excessive blow-down.**

THIRD **—you will entirely avoid pitting of boiler tubes and drums by eliminating dissolved oxygen and CO_2.**

Here's maximum efficiency—a conditioning system that goes all the way and can be depended upon for complete satisfaction and years of service.

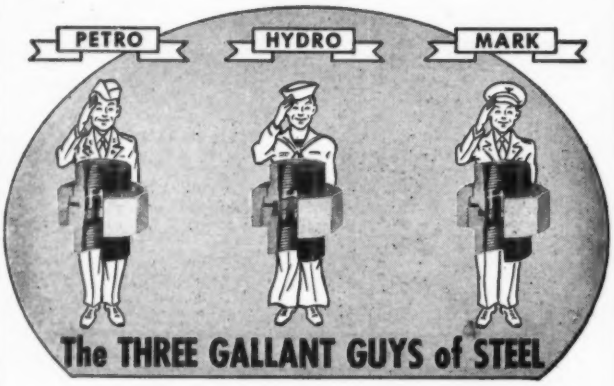
Graver designs, builds, and installs water conditioning equipment of all types. Whatever your problem, consult Graver. Our engineers will gladly submit drawings and estimates without obligation.

GRAVER
WATER CONDITIONING EQUIPMENT

Process Equipment Division
of
GRAVER TANK & MFG. CO., INC.
4809-25 Tod Ave., East Chicago, Ind.
NEW YORK CATASAUQUA, PA. CHICAGO TULSA

Hot Process Water Softeners—Zeolite Water Softeners
Water Filters—Iron Removal Filters—Oil Removal Filters
Reactivators—Chemical Mixing and Proportioning Equipment.

FORGED STEEL UNIONS



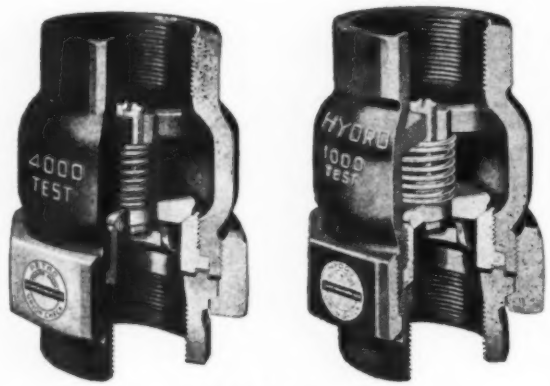
AT YOUR SERVICE WITH
UNION CHECK VALVES
THAT CHECK WITHOUT SHOCK OR NOISE

The spring controls the opening and closing of the valve in accordance with the volume and velocity of the flow.

Can be used in any position—vertical, horizontal, or upside down. Furnished with Navy Bronze or 18-8 stainless steel seats.

Write for pamphlet 4P-HB and give size range you use.

"PETRO" **"HYDRO"**



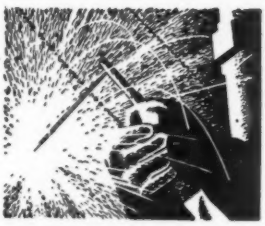
Clayton **MARK** *& Company*

ORIGINATORS AND PIONEERS OF STEEL UNIONS SINCE 1912

EVANSTON **ILLINOIS**

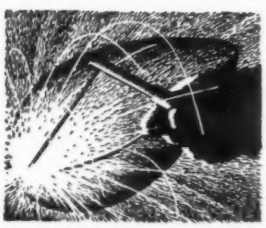
Revolutionary Hy-cycle Automatic Arc Provides Complete Control of Arc and Heat

At last, a development that automatically starts the arc before the welding electrode actually comes in contact with the work! Eliminating the "pecking" or "scratching" that so often creates tension and operator fatigue. Its many advantages contribute largely to saving time and labor because an operator can be trained in far less time than usual, and higher speeds can be obtained. This hy-cycle automatic arc unit, called "Missing Link," permits the operator to weld with any welding rod, bare steel or alloy. Rods that could not be used before can be burned with ease—such as bare mild steel, dust coated, reverse polarity, aluminum, bronze, stainless steel, etc., AC or DC.



Simplifies welding vertica and overhead

One of its most important advantages is welding light gauge. Light gauge requires low heat—making many jobs almost impossible for ordinary methods. Since the "Missing Link" starts automatically on as low as one ampere of heat, the welding of light gauge sheet can be done with surprising speed with no time out for "pecking" and "sticking."



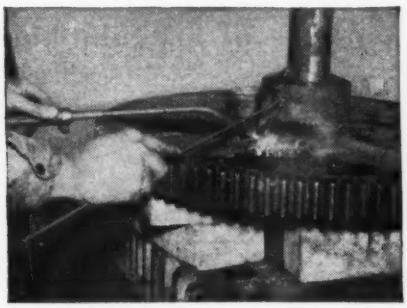
Makes it easy to weld light gauge work

You all know that our fighting men need the finest quality materials that we here at home can produce. That goes for Wrigley's Spearmint Gum, too. Although our stock pile of quality raw materials is getting lower and lower we are maintaining our standards of quality. Naturally, we are forced to limit production. So we are giving priority where it is needed most—and where you want us to—our fighting men and women overseas only. Because chewing gum is essential to them—they are getting all of our limited production of Wrigley's Spearmint Gum.

You can get complete information from Mid-States Equipment Company, 2429 South Michigan Avenue, Chicago 16, Illinois.

Y-134

These LINDE METHODS *Reduce Costs of* MAINTENANCE OPERATIONS



OXY-ACETYLENE WELDING

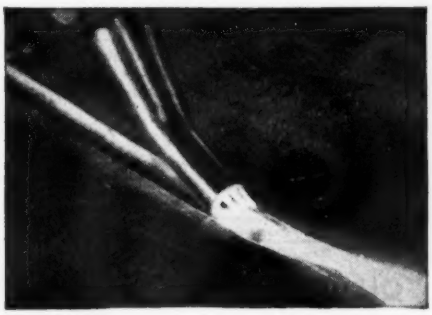
The oxy-acetylene flame makes possible the joining of practically any metals—like or unlike—so that the weld is as strong as the base metal itself. *Welded piping systems* in plants and refineries use less fittings, occupy less space, and remain leakproof indefinitely. *Bronze-welding* and resurfacing speed the repair of worn or broken parts. *Hard-Facing* with Haynes Stellite alloys makes parts subjected to abrasion, heat, or corrosion last from two to twenty-five times longer.

Straightening

Structural steel, shafts, pipe, plate, and other metal parts and structures that have become bent or warped can often be trued up in the shop or on the job by applying the intense heat of oxy-acetylene flames at the right points.

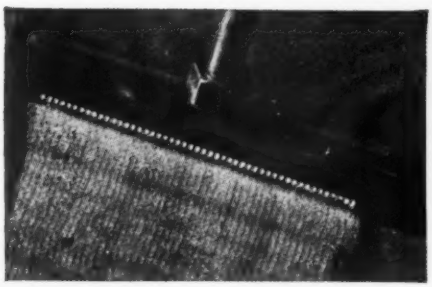
Hand-Cutting

Flame-cutting with manually operated blowpipes is useful for cutting pipe in the fabrication of piping systems. Hand-cutting also is used to cut structural steel in construction or alteration work—to reclaim old pipe—and to cut scrap to length.



Gouging

With Oxweld hand-cutting blowpipes equipped with gouging nozzles, surface metal—such as faulty or temporary welds—can be removed quickly leaving a groove, without need of grinding or chipping, and without harm to the adjacent areas.



Flame-Priming

This process removes loose scale, rust, and surface moisture from steel prior to painting —making paint go on faster, bond tighter, and last longer.

Heating

Heating for bending, straightening, and forming operations is facilitated by the oxy-acetylene flame. Shown here, a pipe is being wrinkle-bent.

Oxygen, Acetylene, Carbide

A booklet describing use of Linde oxygen, Prest-O-Lite acetylene, Union Carbide, and Oxweld apparatus in these and other processes will be sent without charge on request. Ask for Form 5268A.

BUY U. S. WAR BONDS AND STAMPS

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

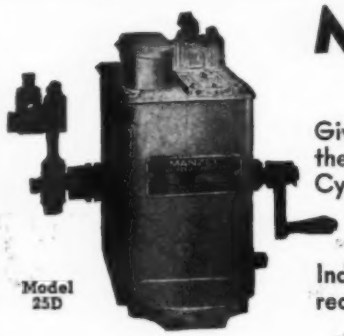
The words "Haynes Stellite," "Linde," "Oxweld," "Prest-O-Lite," and "Union" are trade-marks.

BROWNELL BOILERS

For 88 years this company has been making good boilers. We invite comparison on quality, price, and delivery of various types and sizes of fire tube boilers from 3 H. P. to 250 H. P.

Write us for illustrated bulletins.

THE BROWNELL COMPANY
The World Over
since 1856
DAYTON, OHIO, U.S.A.



Model 25D

MANZEL LUBRICATORS

Guard Cylinders and Bearings 24 Hours a Day!

Give your engines, pumps, compressors and other heavy machinery the protection of the sure, safe, dependable lubrication delivered by Manzel Force Feed Lubricators. Cylinders and bearings lubricated the Manzel way get exactly the right amount of oil at exactly the right time.

Manzel Lubricators have an individual pumping unit for each lubrication point. Individual feeds are easily adjusted and very accurate. Once feed is set the lubricator requires no attention except to keep oil reservoir supplied.

Write for Catalog 25-D

MANZEL BROTHERS COMPANY **326 Babcock St., Buffalo 10, N. Y.**

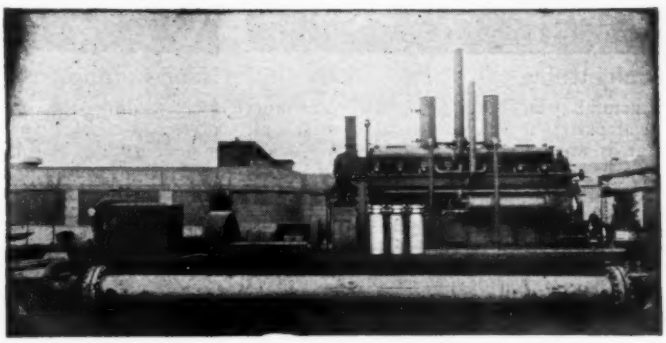
YOU CAN

ADD HOURS

TO THE LIFE OF DIESEL ENGINES

with

NUGENT FILTERS



HERE'S a filter that's a sure bet when it comes to providing positive protection for Diesel engines. The Nugent Absorbent Depth Type Pressure Filter shown at the left absorbs four times its own weight of water and impurities yet it does not remove any of the essential additives embodied in the oil. Available in a wide range of sizes for Diesel engines from 1 to several thousand H.P. in single containers.

Diesel operators who can't take a chance with power interruptions rely on Nugent Filters to add hours of life to Diesel engines . . . reduce maintenance costs as well as increase engine efficiency.

The photo above shows one Nugent Absorbent Type Fuel Oil Filter and two Nugent Lubricating Oil Filters installed on a Cooper-Bessemer Diesel engine which is connected to Worthington centrifugal pump. The installation is located at a well known pipe line station.

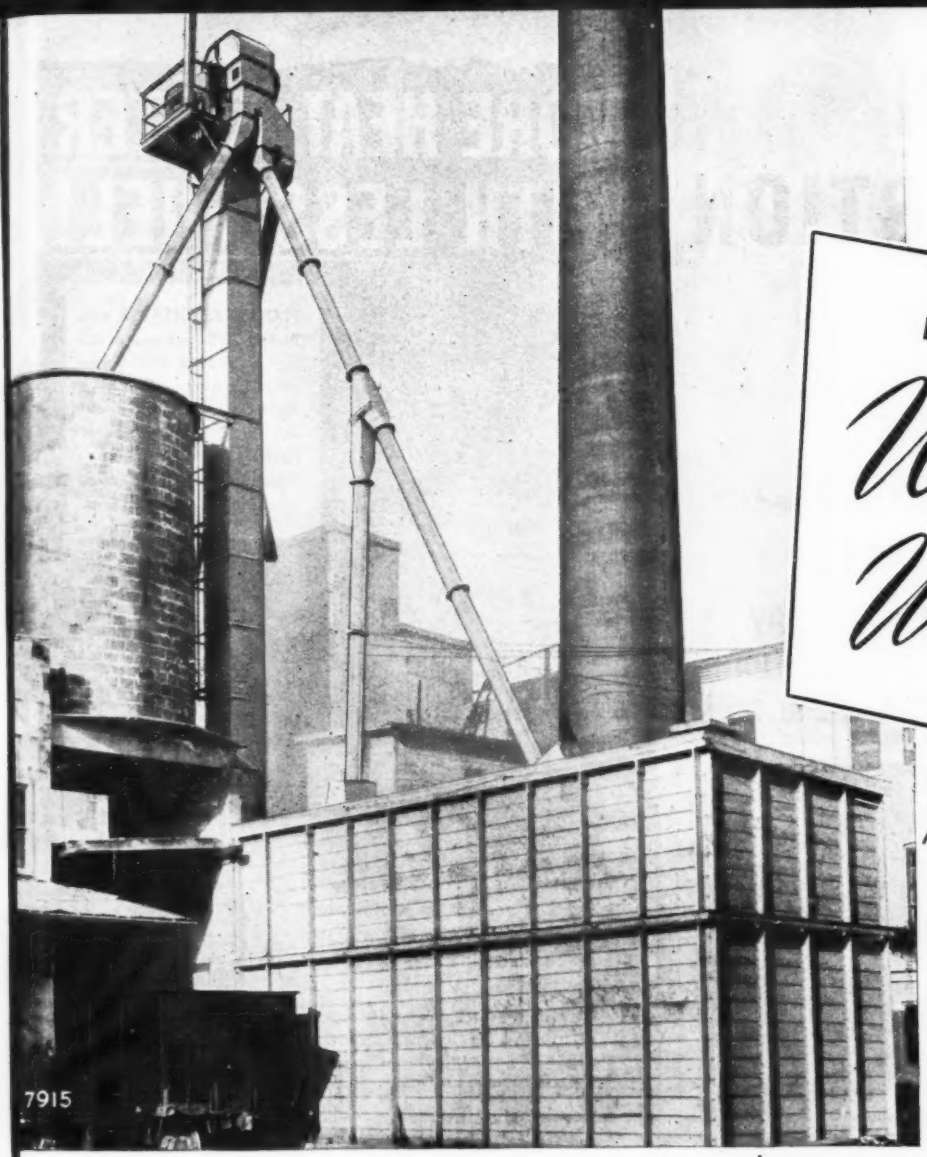
WRITE TODAY for Latest Bulletin

WM. W. NUGENT & CO., INC.

402 N. Hermitage Ave. Chicago 22, Ill.

SINCE 1897

NUGENT FILTERS



PUTS COAL
Where YOU WANT IT
When YOU NEED IT

S-A Bucket Elevator with encaged safety ladder and drive platform. Buckets elevate coal from track hopper to storage silo at left, or to bulk storage crib shown at right.

Low Cost Coal and Ash Handling Assured by S-A Conveying, Elevating Systems

Coal and Ash Handling problems would be much more simple if there were a "standard" handling system which any plant could apply.

However, each plant has its *individual* handling problems for both coal and ash and it is in the solution of such widely differing problems that S-A specializes.

The reasons for S-A's success in this field are threefold: (1) S-A manufactures a *complete* line of conveyors, elevators, feeders, crushers and transmission equipment. (2) Experienced S-A engineers have the vital "Know-How" of combining equipment into efficient economical handling systems. (3) S-A's 43 years of experience have been devoted exclusively to the development of better material handling methods and equipment.

Write us for assistance when planning new or improved handling systems.

STEPHEN S-A DAMSON MFG. CO.

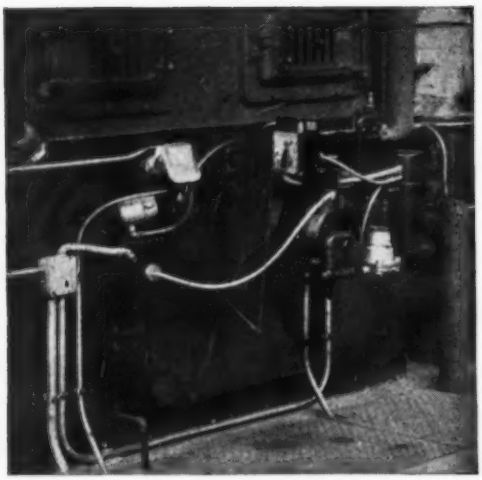
5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT

EXPLOSION PROTECTION

for

- Gas
- Oil
- Powdered Coal
- or for any combination of these fuels



A typical combination gas and oil burner —Flame - otrol installation. (Complete purging cycle, safety shut-off features and pilot light of sufficient size to insure main flame stability).

Wheelco FLAME-OTROL

—is a Wheelco pioneered electronic achievement, which provides dependable protection against explosion hazards by instantly shutting off the fuel to the burner in case of flame failure, disturbance in the electrical system, or should any condition develop within the instrument itself which might interfere with its operation. Fuel and explosive products accumulation, the source of explosion hazard is eliminated. Available with automatic or manual ignition, time delay for purging, or other desirable sequences.

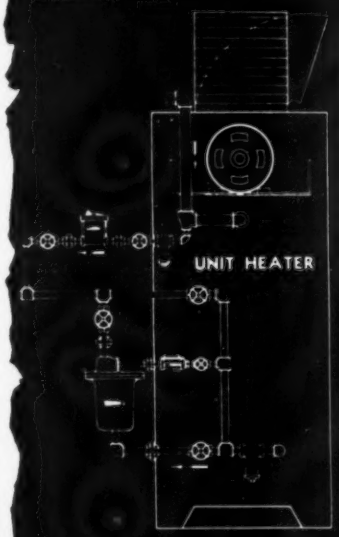
Request Bulletin L2

WHEELCO INSTRUMENTS COMPANY

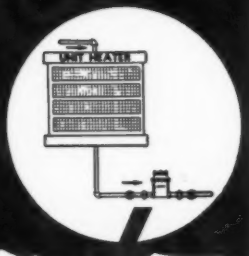
863 West Harrison St. Chicago, 7, Ill.

Creators of "Electronic Principle" Temperature Controls

MORE HEAT · FASTER WITH LESS FUEL!



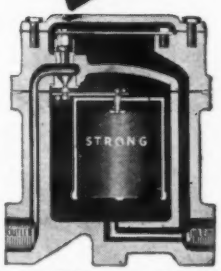
FLOOR-TYPE HEATER with Strong 70 Series trap draining inlet line, and 80 Series with Thermal Air Valve draining heater. Note strainers ahead of traps. OVERHEAD HEATER (circle) drained by Strong 70-T trap, with built-in thermal vent.



Accumulated condensate and trapped air can make unit heaters slow in starting. Uncertain drainage can seriously reduce heat output.

Leaky Traps Waste Fuel

While all Strong Inverted Bucket Traps will handle large amounts of air, the hookups shown here provide thermal air vents for practically instantaneous heating. Use of Strong anti-balancing traps, guaranteed for a year against leakage, insures positive drainage without waste of steam.



Strong 70-T trap with built-in bi-metal air vent. For saturated steam pressures to 150 p.s.i.

• • •

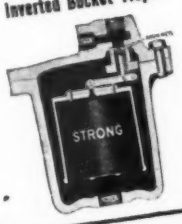
Completeness of the Strong line enables us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, welded, cast and semi-steel construction. Send your drainage problems to Strong, Carlisle & Hammond Co., Cleveland, Ohio.

OTHER STRONG STEAM SPECIALTIES

Reducing Valves

Fabricated Steel Traps

Inverted Bucket Traps



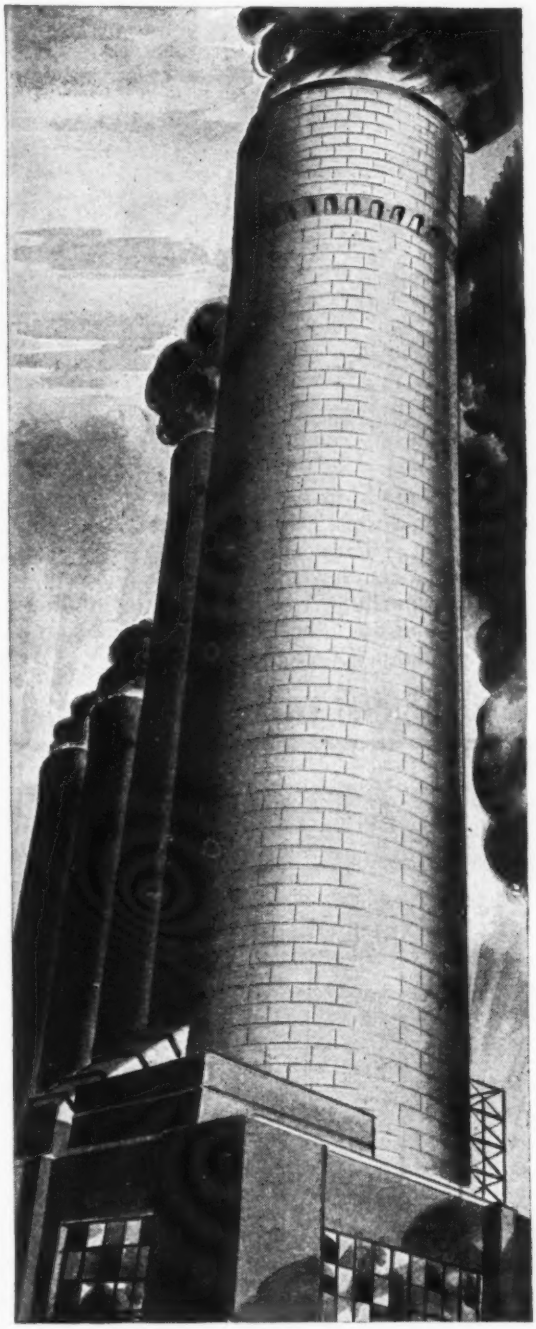
P-543

STRONG

STEAM SPECIALTIES

SAVE WAR-VITAL FUEL!

Don't let it "Go up in Heat Waves"...



Fuel can be wasted not only by "going up in smoke", but also by "going up in heat waves"—in units of boiler-plant heat *lost through inadequate insulation.*

Today, with fuel demands at a higher-than-ever peak, industry must conserve every B.T.U. in its production of heat and power.

Power plants throughout the nation—public utilities, war and general industries—are obtaining maximum kilowatt production from minimum fuel with the aid of "always dependable"

Carey HEAT INSULATIONS

Carey's large production facilities—nationwide distribution service and specially trained engineers and erection crews of the Carey Contract Organization insure completion of your insulation jobs on schedule. No job too large or too small. Write for information to Dept. 16.

THE PHILIP CAREY MFG. COMPANY

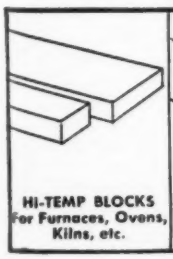
Lockland, Cincinnati 15, Ohio

Dependable Products Since 1873

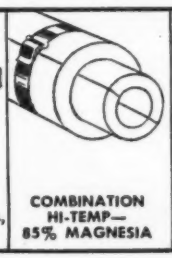
In Canada: The Philip Carey Co., Ltd., Office and Factory: Lennoxville, P. Q.

CAREY HEAT INSULATIONS

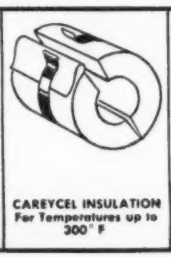
▶ *COMPLETE LINE OF HEAT INSULATIONS* ▶ *NATION-WIDE DISTRIBUTION* ▶ *TRAINED SERVICE AND ERECTION CREWS*



HI-TEMP BLOCKS For Furnaces, Ovens, Kilns, etc.

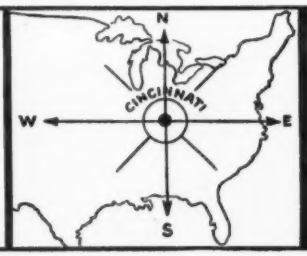


COMBINATION HI-TEMP—85% MAGNESIA

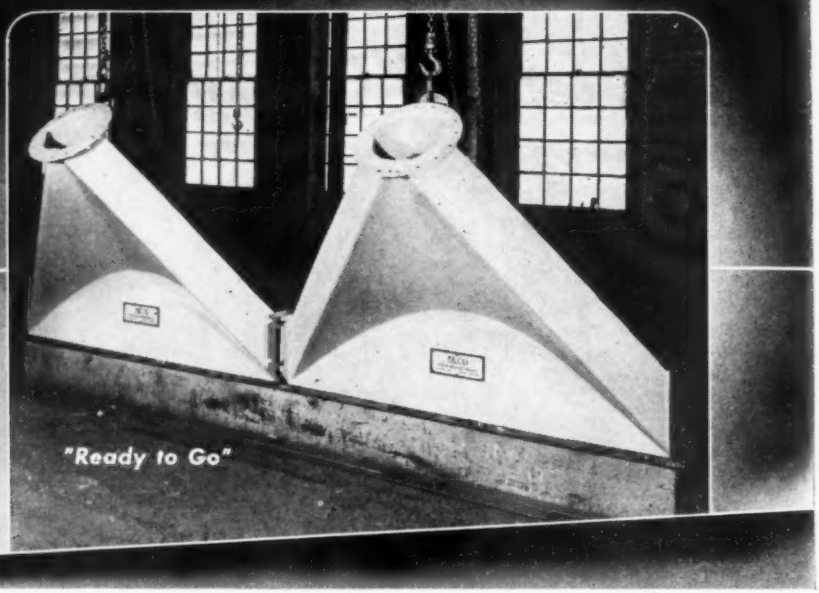


CAREYCEL INSULATION For Temperatures up to 300° F

85% MAGNESIA For High and Medium Pressure



Why not a BIG Patch this time?



• It is general practice, when coal chutes wear thin and develop holes, to patch and repair and "make do". Next time such maintenance is needed why not do a complete job . . . replace with S. E. Co. CONICAL Non-Segregating Coal Distributors? Complete units, such as shown in the photo above, can be supplied to meet your individual needs . . . ready to slip into place for immediate use. The cone principle insures constant, even distribution of large and small coal—improves boiler and combustion efficiency and increases stoker capacity. Write today for full information. Address Stock Engineering Co., 715 Hanna Bldg., Cleveland, 15, Ohio.

STOCK

★ ENGINEERING CO. ★

CONICAL Non-Segregating Coal Distributors **S.E.Co. Coal Valves and Coal Scales**

ESS SMOKE and COMBUSTION INDICATORS, CONTROLLERS and RECORDERS

. . . the tell tale of combustion efficiency . . . show the boiler haze . . . save fuel . . . permit automatic burner adjustment.

Simple in design . . . rugged in construction, they operate efficiently with a minimum of maintenance.

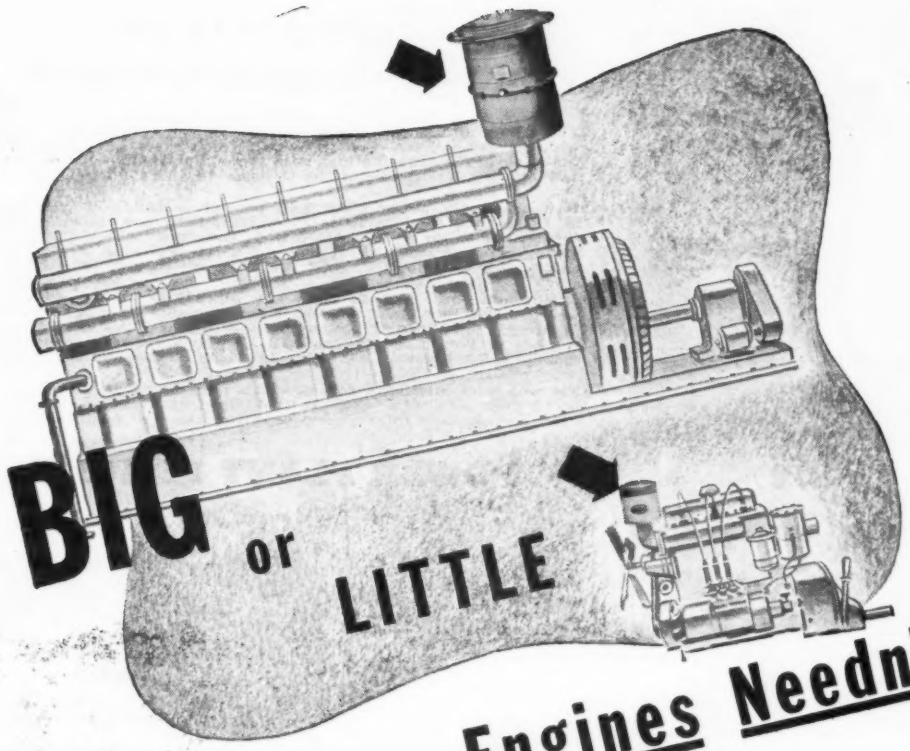
WYD-ANGLE PERISCOPE for visual operation

ELECTRONIC HAZE GAGE for automatic signal operation

ESS INSTRUMENT CO., FORT LEE, N. J.

Indicators, Controllers and Recorders for SMOKE & COMBUSTION . . . SPECIFIC GRAVITY . . . TURBIDITY . . . FLAME FAILURE . . . INDUSTRIAL and SAFETY APPLICATIONS

Write for catalog

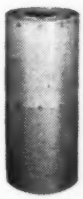


BIG or LITTLE Engines Needn't "SNORE"

A Type for Every Application

Oil bath type filter-silencer for heavy-duty service. Filter element features automatic oil-washing action. Silencing chamber requires no attention.

Closed circuit (in-line) Multimaze filter-silencer. Design permits both air intake and unit to be placed in best locations.



Unimaze filter-silencer for use with small engines and compressors where dirt conditions are not severe.

Engine and compressor intake air can be a nuisance as well as a danger. It requires filtering to remove harmful abrasives. And in many installations, effective silencing vastly improves working conditions and operators' efficiency.

Air-Maze filter-silencers combine various types of filters with efficient silencing chambers. These sound dampeners are integral parts of the unit. Sizing the filter, therefore, automatically provides the correct silencing chamber.

Air-Maze engineers will gladly recommend the correct type for your engine and compressor. For data on these and other Air-Maze products, write for General Catalog AGC-144 and Bulletin FSP-89 on filter-silencers.

AIR-MAZE CORPORATION • ***Engineers and Manufacturers*** • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • ***In Canada:*** **Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.**

ARMY E NAVY

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

ROPER ROTARY PUMPS

Help to Keep 'Em Flying

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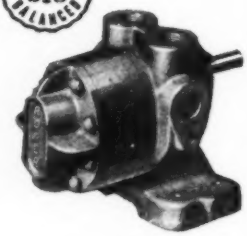

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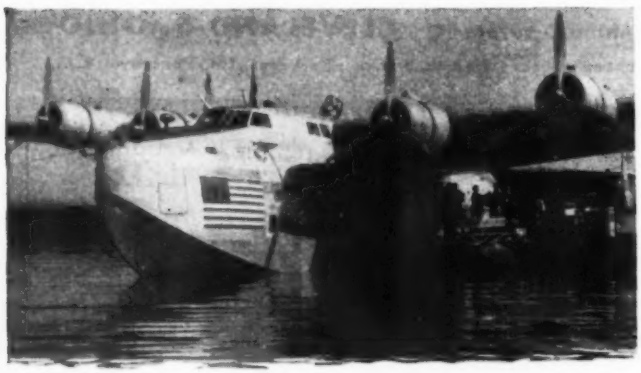

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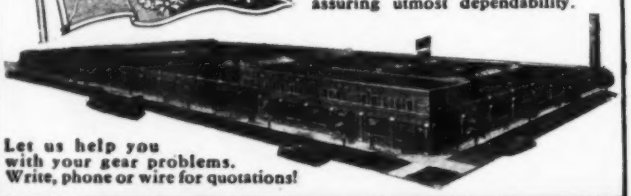

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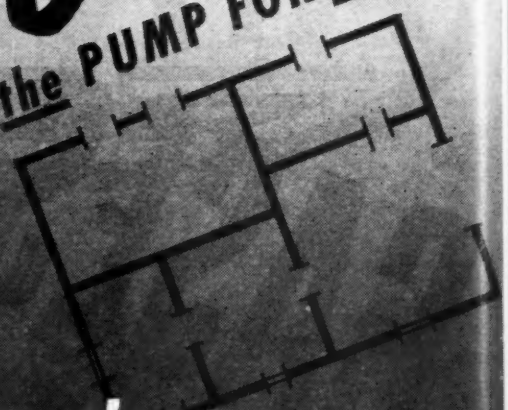

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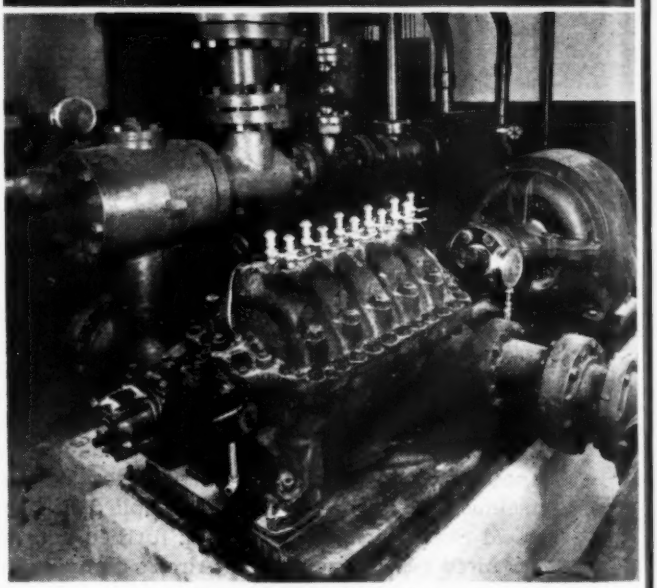

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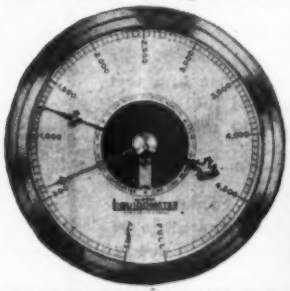

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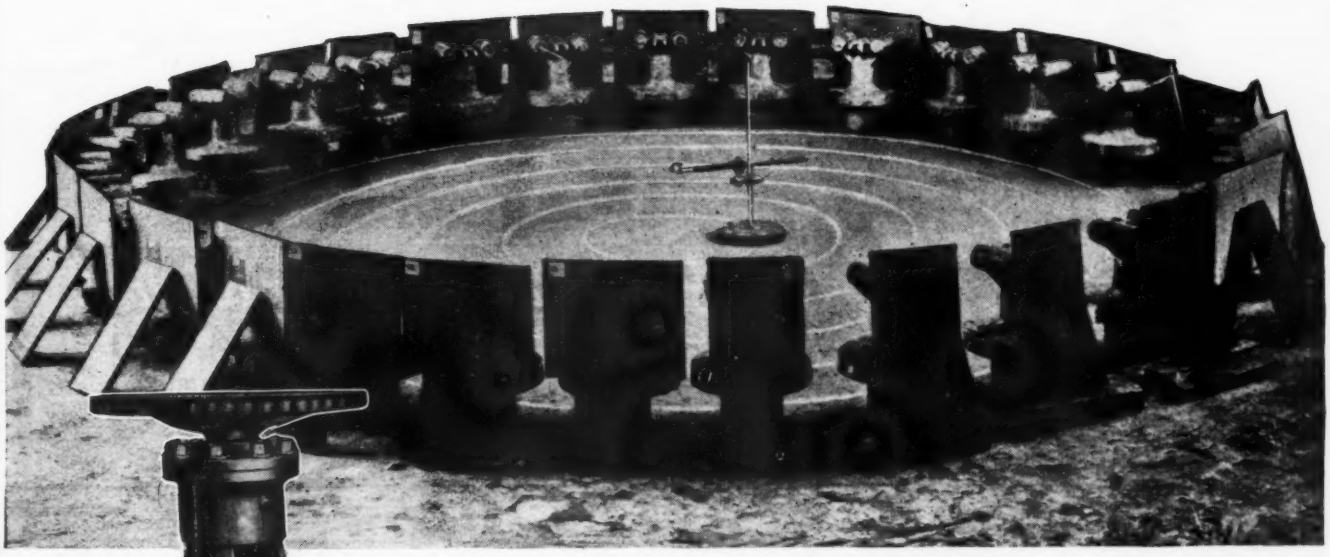

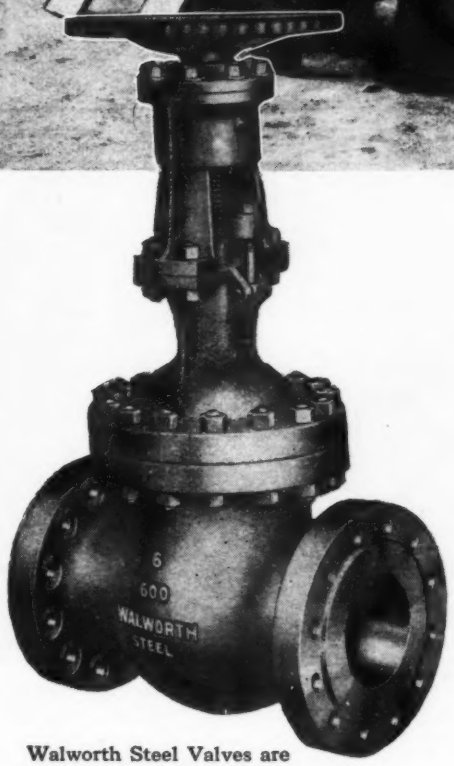

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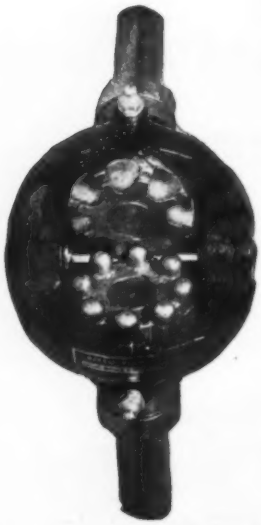

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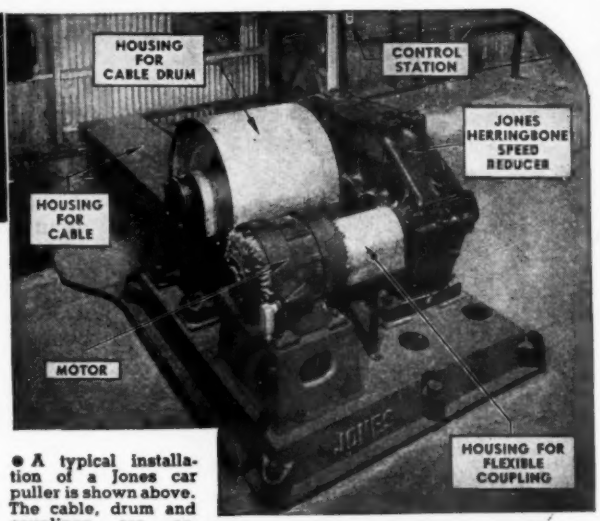

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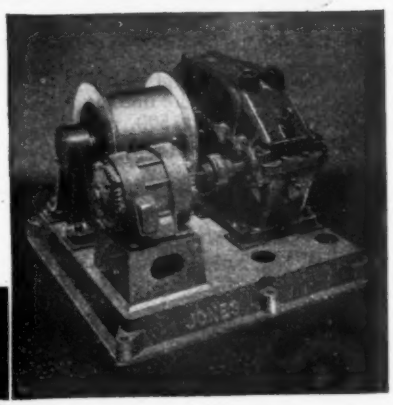

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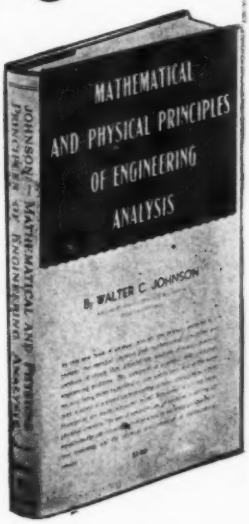

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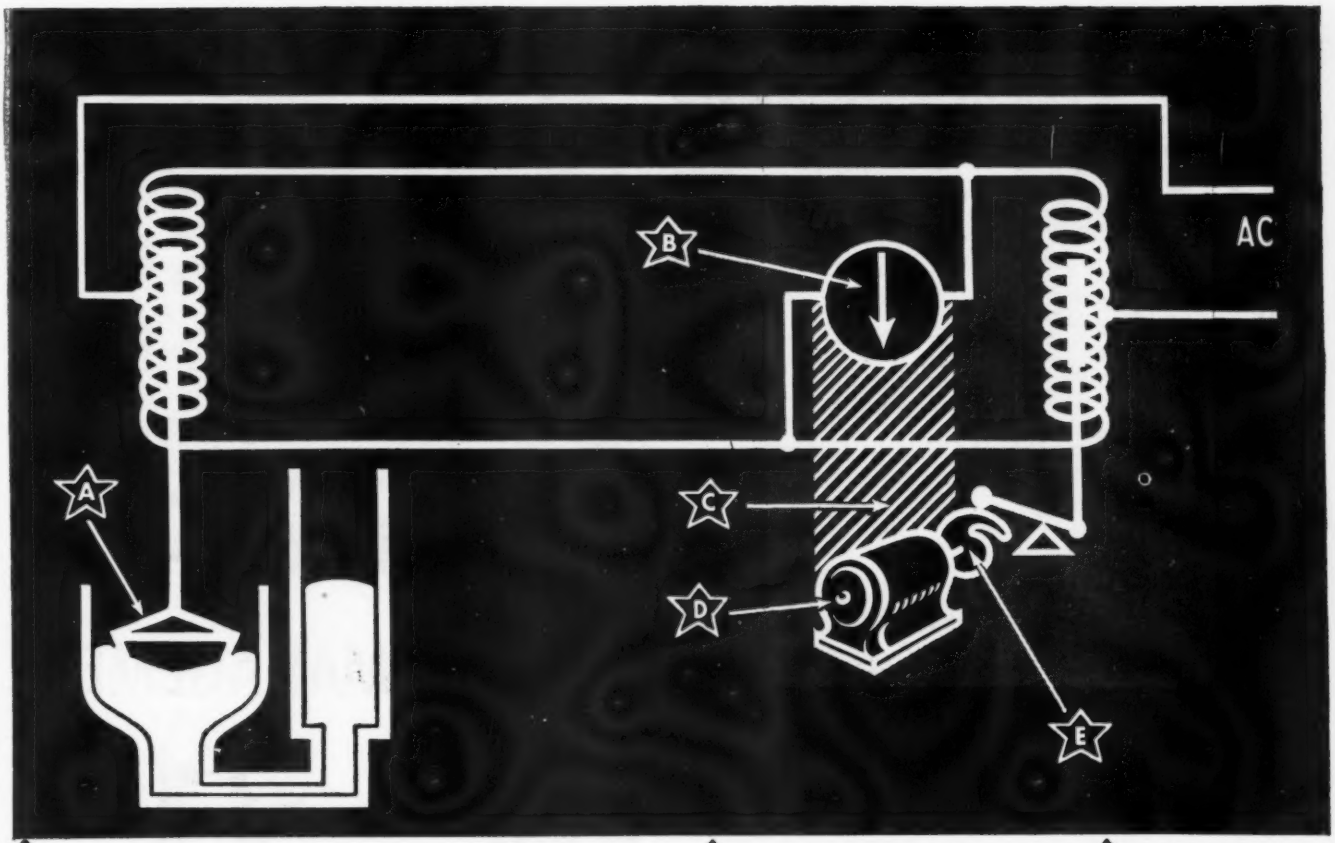

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Study this diagram

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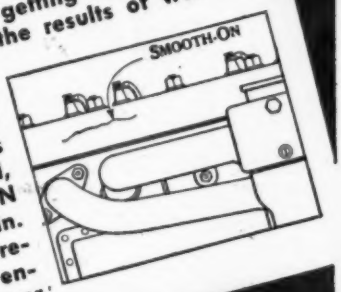

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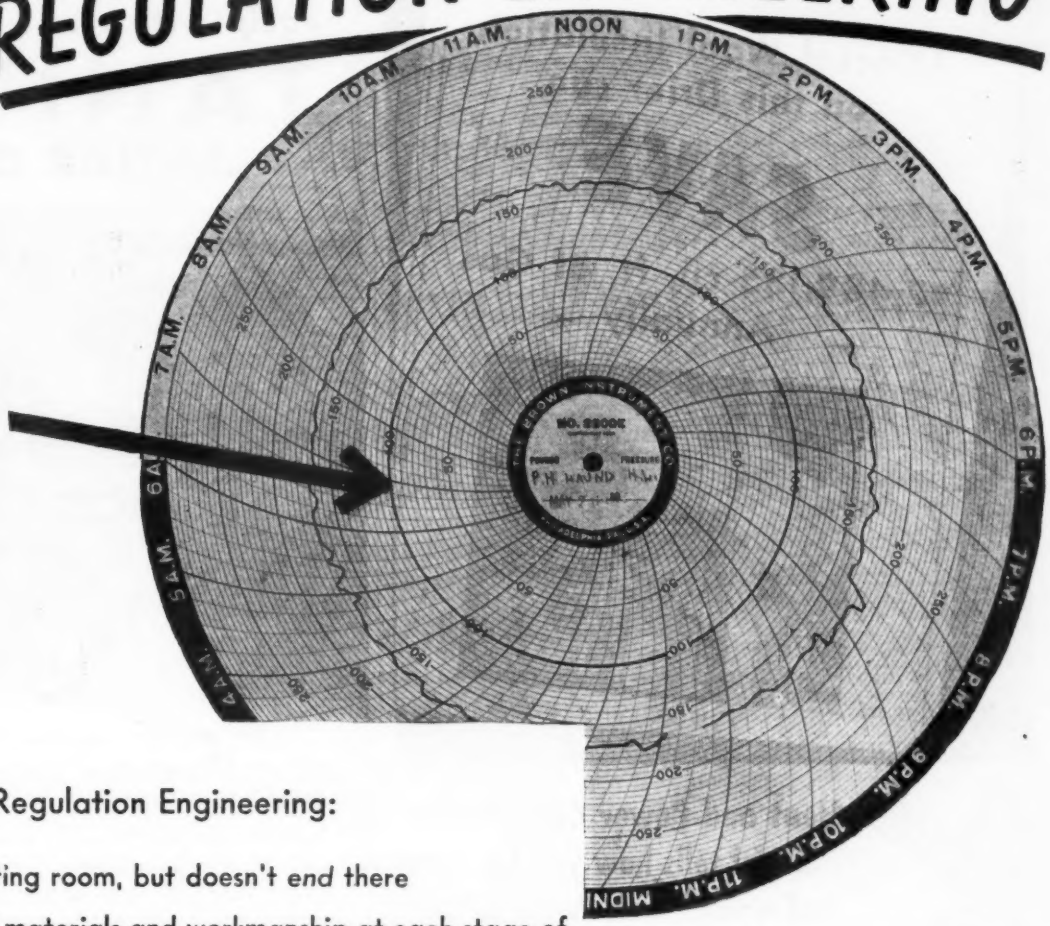

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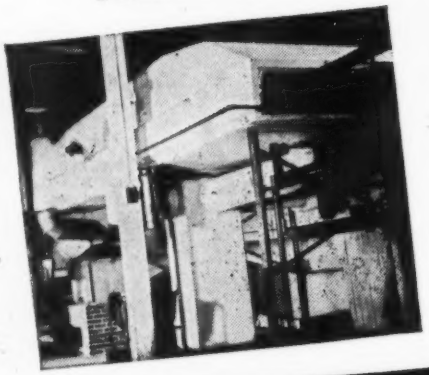

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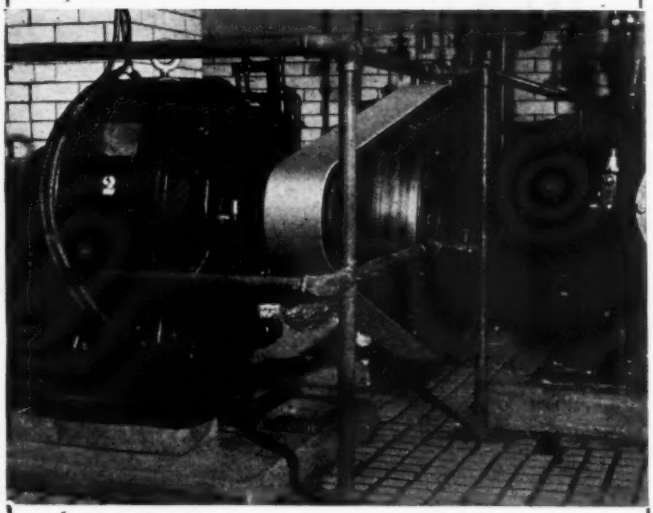

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MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

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Arsenical Copper—For good fresh water conditions. Has excellent heat conductivity. Used for condensers and feed water heaters for river waters

SELECTING CONDENSER TUBING For Retubing and New Construction

Power plant engineers who have been nursing their condenser tubes beyond their normal usage will welcome the easing of government restrictions on condenser tubes. Every standard alloy (with the exception of cupro nickel, which is still limited) is now available for power plant and marine use. In addition, condenser tube manufacturing capacity is also now available. However, orders for condenser tubing should be placed well in advance of actual requirements because of inevitable delays in the allocation of raw materials, processing, etc.

Much data has been accumulated on condenser tubes operating under forced wartime conditions that should prove helpful when selecting new tubes for long, satisfactory life. Those engineers who have planned ahead and who have been testing experimental lots of condenser tubing in various alloys are most fortunate because they know definitely the limitations of each alloy tried out under existing operating conditions. Those who do not have this data can avail themselves of Bridgeport's laboratory service for considerable help in this direction.

Which Condenser Tube Alloy Will Give the Best Service?

With better processing equipment and the benefit derived from consistent laboratory research on corrosion, better quality, and wider choice of condenser tube alloys can be obtained. It requires both good judgment and experience to select the correct alloy for a particular installation because no two operating conditions are exactly alike.

If a certain alloy has been giving satisfactory service, and conditions have not changed, there is no good reason for using a different condenser tube alloy. On the other hand, if an installation is not standing up, and a change of alloy is indicated, a careful study of the circulating water, operating procedure, type and intensity of corrosion on representative full length tubes should be made. The characteristics of each available alloy should then be carefully studied.

To help in the selection of a new condenser tube alloy, we are briefly listing the characteristics of standard Bridgeport alloys. For more complete engineering data, corrosion studies, and specifications, we suggest that you write for a copy of our 112-page Condenser Tube Manual.

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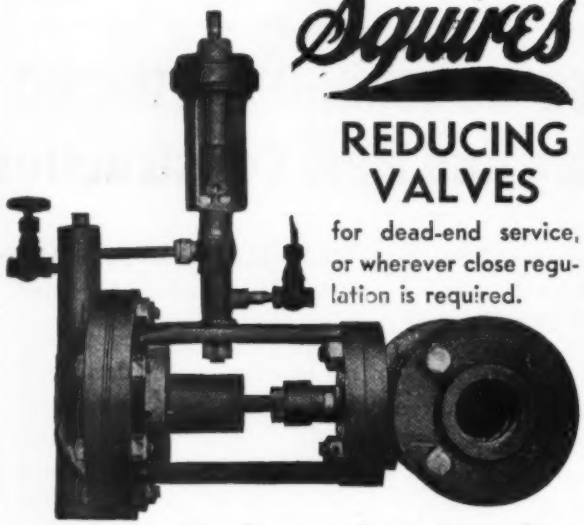

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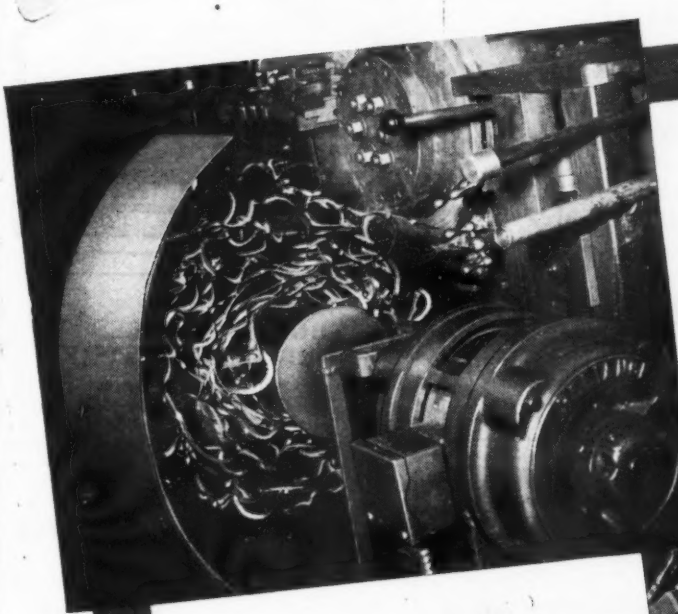

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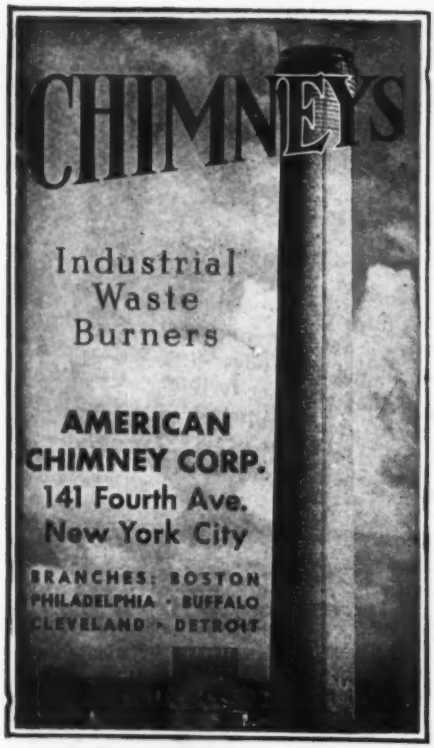

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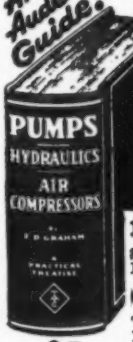

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3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

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1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
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1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—150 KVA Pittsburgh, 2300/115/230 volts, 1 PH, 60 cy.
2— 75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 Volt, 60 cycle 150 R.P.M. P. F. .08 with separate belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 R.P.M. with direct connected exciter.
200 KW Westh. Unity Power Factor, 3 PH. 60 cyc. 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 R.P.M., revolving field, built-in exciter.
150 KW Elect. Mach. Revolving fields 3 ph. 25 cy. 440 volts 750 R.P.M.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 R.P.M.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.
100 K.W. Gen. Elect. 3 BRG. 125 Volts D.C. Comp. WD. INT. with 220/440 Volts Sq. Cg. Motor.

CRANE MOTORS

75 H.P—G. E. 51—230 Volts—550 RPM
35 H.P.—G. E. Form D—550 Volts—590 RPM
25 H.P.—Form E—550 Volts—760 RPM

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

FREQUENCY CHANGERS

40 KW GE type I.T.T. frame 553 3 ph. 25/62, ½ cy. 220 volts primary 440 volts secondary, 750 R.P.M. direct con. to 40 H.P. GE type KT543—3 ph. 25 cy. 220 volt, 750 R.P.M.

OTHERS IN ALL SIZES VOLTAGES AND CYCLES

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
300	Ideal	Syn.	P.F. .08	900	4000
250	West	S.C.	C. S.	900	440
200	West	Syn.	.08 P. P.	900	220/440
		WITH DIRECT CON. EXCITER			
200	Wsghse.	Sl.Rg.	CW	600	220/440
200	Wsghse.	Syn.	Dir. Con. Exc.	600	2300
200	Gen. Elec.	Syn.	ATi	514	400/2300
150	Gen. Elec	Sq. Cg.	I	600	2300
150	Al Ch	Sq. Cg.		600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph.	900	220/440
125	Gen. Elec.	Sl. Rg.	NT. 553	1200	220
125	Gen. Elec.	Sq. Cg.	I K	720	220/440
25	Gen. Elec	Sq. Cg.	I. K. Vert.	720	220

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
350	Gen. Elec.	Sl. Rg. 3 Brg.	I	375	440
250	Ideal	Syn.		375	4000/2300
200	Lincoln	S. R.	I. X. W.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/400
100	Gen. Elec.	Sq. C.	I K	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CCI.	500	220/440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S.R.	I.M. 17B	160	440

230 D. C. MOTORS

H.P.	Make	Type	Speed
150	West	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D—Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	560
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
35	West	SK 150—Shunt Int 550 volts	850

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK

THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

ELECTRICAL POWER EQUIPMENT

MOTOR GENERATORS

3 Phase, 60 Cycle

1500 KW WESTINGHOUSE synchronous, 250 volts D.C., 2300 volts A.C., 514 RPM.

1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D.C., 4000/2300 volts A.C., 720 RPM.

300 KW WESTINGHOUSE synchronous, 250 volts D.C., 2300 volts A.C., 1200 RPM.

TURBO GENERATORS

3 phase 60 cycle

4000 KVA ALLIS CHALMERS condensing, 175 lbs., 2300 volts with jet condenser

3750 KVA GENERAL ELECTRIC condensing, 200 lbs., 2300 volts with surface condenser

1875 KVA GENERAL ELECTRIC condensing, 160 lbs., 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS condensing, 150 lbs., 2300 volts with jet condenser

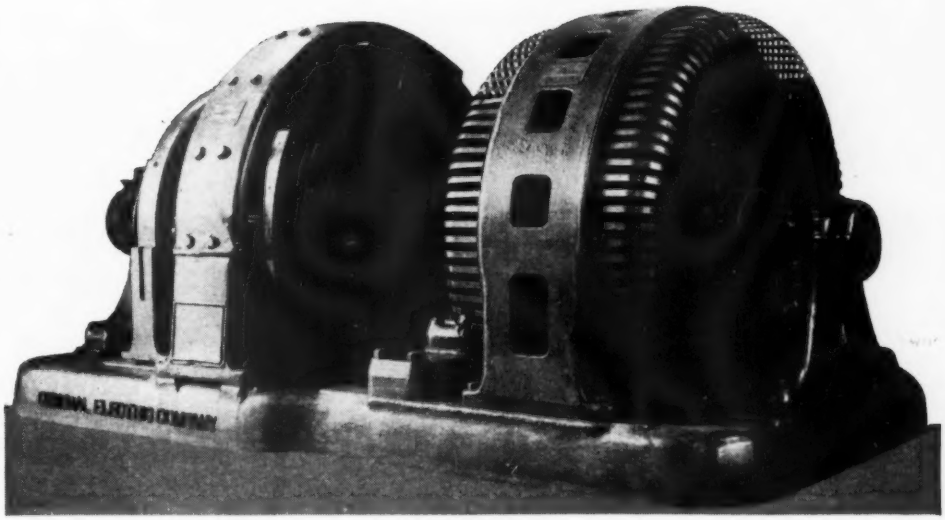
TURBO GENERATOR

250 volts D.C.

500 KW GENERAL ELECTRIC automatic extraction, 150 lbs. 0-28 lbs. extraction, with surface condenser

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps



Actual Photograph

1000 KW Motor Generator Set

1000 KW (2) General Electric generators 250 volts, 720 RPM direct connected to 1400 HP General Electric synchronous motors, 3 phase 60 cycle 4150/2300 volts. *Complete with control. Can be shown in operation.*

Actual Photograph

3500 KW Rotary Converter

3500 KW (2) Westinghouse booster type interpole rotary converters, 225-285 volts D.C. 225 RPM; 60 cy. A.C., with 3 ph. 60 cy. 13200 volt transformers. *Complete with control. Can be shown in operation.*

ROTARY CONVERTER

3 Phase, 60 cycle

750 KW GENERAL ELECTRIC 600 volts D.C., 1200 RPM with 2300/4000 volt transformers

ENGINE GENERATORS

3 Phase, 60 Cycle

675 KVA BURKE-NORDBERG uniflow, 175-200 lbs. 15 lbs. back pressure, 2300 volts

210 KVA GENERAL ELECTRIC engine type generator, 2300 volts, 225 RPM

150 KVA GENERAL ELECTRIC AMES counterflow, 125 lbs. 5 lbs. back pressure, 240 volts

ENGINE GENERATOR

250 volts D.C.

500 KW CROCKER WHEELER-AMES, 4 cylinder vertical uniflow, 150 lbs., 4 lbs. back pressure

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD CLEVELAND, OHIO

How the Policy of BELYEA Protects You—*the buyer*

(1) When your electrical power problems are presented to the Belyea Company they receive the benefit of a combined practical and theoretical experience of more than 100 years in this field.

With ample theoretical knowledge to know the "why?" combined with thorough experience and practical knowledge to know the "how?" the Belyea Company is fully qualified to analyze your particular problem.

During the 36 years of the company's existence it has witnessed many successful and some unsuccessful changeovers from mechanical to electrical drive. These conversions have been in all the heavy industries such as rubber, paper, steel, etc. It is the benefit of these experiences that you,—the buyer, gain when your application problems are analyzed by the Belyea Company,

Remember this—you get a guarantee of successful operation with all **RE-NU-BILT** equipment.

1. ANALYSIS OF YOUR PROBLEMS
2. CONSERVATIVE RECOMMENDATIONS
3. CONSISTENT STANDARDS OF REBUILDING & TESTING
4. TIME SAVING DELIVERY SCHEDULES
5. REASONABLE PRICE POLICY

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW, Whse. 250 v D.C. to 2100 HP, 2300/4600 v syn.

1—1500 KW, G.E. 275 v D.C. to 2100 HP, 2300 v syn.

1—1000 KW, Whse. 600 v D.C. to 1400 HP, 4000 v syn.

1—1000 KW, G.E. 275 v D.C. to 1400 HP, 2300 syn.

1—600 Kva, G.E. 330 KW, 220/440 v A.C. Gen. to 500 HP, 230 v D.C. motor

1—580 KW, G.E. 600 v D.C. to 700 HP, 13200/6600 syn. with exciter

1—500 KW, G.E. 275 v D.C. to 1000 Kva, 2300 v syn. with exciter

1—400 KW, G.E. 275 v D.C. to 700 HP, 2300 v syn. with exciter

1—75 KW, G.E. 125 v D.C. to 120 HP, 2300/4000 v sq. cg.

1—50 KW, G.E. 125 v D.C. to 75 HP, 2300/4000 v sq. cg.

1—40 KW, Whse. 250 v D.C. to 45 Kva, 2300 v syn.

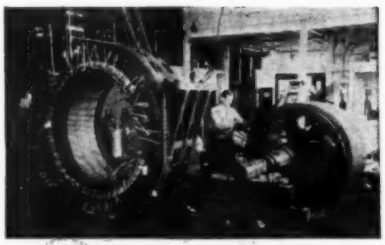
1—35 KW, Whse. 125 v D.C. to 50 HP, 2300 v sq. cg.

1—25 KW, G.E. 125 v D.C. to 40 HP, 220 v sq. cg.

FREQUENCY CHANGERS

1—75 KW, G.E., with 94 Kva .8 PF, 240 volt, type ATB, 3 phase, 62½ cycle gen. and 125 HP, 440 volt, 3 phase, 25 cycle motor

1—1000 KW, G.E., with 1250 Kva, .8 PF, AQB, 2300 volt, 2 phase (can be changed 800 KW, 3 phase), 58.3 cycle gen. and 1400 HP, .8 PF, 4400/2200 volt, ATI, 3 phase, 25 cycle motor and exciter



A C MOTORS

3 phase—60 cycle

SLIP RING

Qua.	Hp.	Make	Type	Volts	Speed
1	1200	Cr. Wh.	801Q	2300	237
2	1000	Whse.	CW	2300	720
1	800	Al. Ch.	ANY	440	885
1	800	Whse.	CW	440	357
2	600	G.E.	IP	440/2200	720
1	600	G.E.	MT	550	220
1	450	Whse.	HF	2200	875
1	400	G.E.	IP	2200	252
1	400	Al. Ch.	ANY	2300	505
1	400	G.E.	IP	440/2200	600
1	350	G.E.	MT-442Y	2200/4000	253
1	300	G.E.	IM	440	720
1	300	Whse.	CW	440	585
1	250	G.E.	MT-424Y	4000	257
1	200	G.E.	IM	440	600
1	200	Whse.	CW	2200	514
1	150	G.E.	I-17B	2200	290
1	150	Whse.	CW-772C	2200	1160
1	150	G.E.	IM-16	2200	575
1	150	G.E.	IM-17	2200	450
1	100	G.E.	IM	550	720
2	100	G.E.	IM	2200	575
1	100	G.E.	MTC	550	685
1	100	G.E.	IM	220	1750

SQUIRREL CAGE

Qua.	HP	Make	Type	Volts	Speed
1	500	G.E.	IK-17B	2200	690
1	300	Whse.	CS	550	580
1	300	G.E.	IK-17B	550/440	600
1	200	G.E.	IK-17B	2200	490
2	175/112	G.E.	IK-16	440	900/720
1	125	Whse.	CS	550/220	1150
1	100	G.E.	IK-Vert.	2300	450

ROTARY CONVERTERS

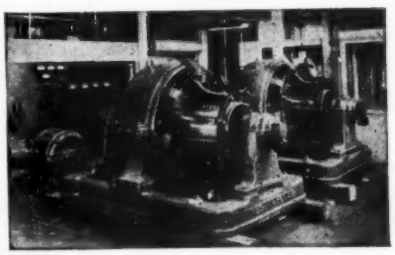
3 phase—60 cycle

Qua.	KW	Make	Speed	DCv	Trans V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	260	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	1000	Whse.	720	250	22000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/6600
2	375	G.E.	1200	250	6600/2300

3 phase—25 cycle—Booster Type

1	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC Panels.



D. C. MOTORS

Qua.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
2	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.	Int.	230	525
1	175	Whse.	SK	250	150/525

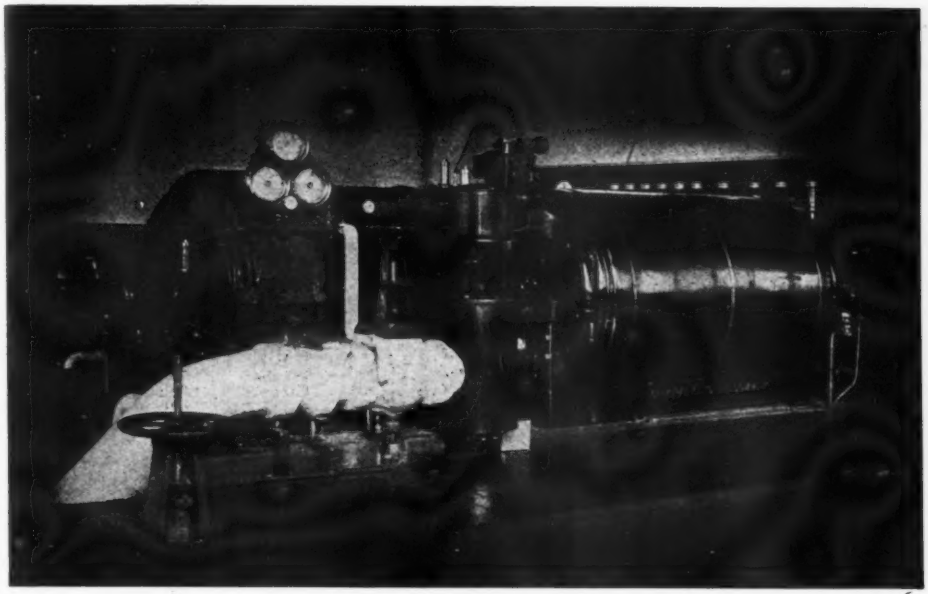
RE-NU-BILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

937½ KVA G.E. automatic extraction condensing, 175 lb. pressure, 125°F. superheat, 15 lb. gauge, 2300 volts, 3600 RPM—complete.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ROTARY CONVERTERS

1500 KW Westinghouse synchronous 250 volts, direct current—6 phase, 60 cycle alternating current, 514 RPM.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

400 KW Crocker-Wheeler, 250 volts, 150 RPM generator direct connected to a 26" x 32" Skinner Unaflow non-condensing engine.

400 KW (2) General Electric, 250 volts, 150 RPM generators each direct connected to Elliott Ridgway 4-valve engine.

350 KW G.E. 250 volt, 175 RPM generator direct connected to a 28" x 28" Skinner Universal Unaflow non-condensing engine.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry noncond. turbine-gen. unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle

Alternating Current

375 KVA G.E. 2300 volts, 200 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

350 KVA G.E. 2300/550 or 440 volt, 200 RPM generator direct connected to a 23½" x 24" Skinner Universal Unaflow engine.

312 KVA Elliot 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

MOTORS

—3 phase, 60 cycle

900 HP G.E. 240 volts, 900 RPM synchronous.

500 HP 80% P.F., G.E., 240 volts, 900 RPM synchronous motor with direct connected exciter.

500 HP Westinghouse 2200 volt, 1750 RPM squirrel cage induction.

125 HP 80% P.F. Elec. Mchy, 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3 ph., 60 cy., 2300 v. alternating current generator dir. con. to 910 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIALS

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

350 GPM, 720' head, 5 stage Allis-Chalmers centrifugal pump direct connected to 125 HP, 3 phase, 60 cycle, 2200 volt, 1750 RPM motor.

23½" x 24", 200 RPM Skinner Universal Unaflow non-condensing engine. Modern.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

SYNCHRONOUS CONDENSERS

1350 KVA

Total Capacity

750 KVA and 600 KVA G.E. type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers each complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

L. J. LAND AND COMPANY

MOTORS & GENERATORS

SOLD WITH A ONE-YEAR GUARANTEE

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	R & M	1160
20	G.E.	1150
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850
10	G.E.	825
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Pearl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
75 KW West.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW West.	125 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
200	G.E.	495
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al. Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
147	West.	715
100	G.E.	1200
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
50	G.E.	3600
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865
25	G.E.	900
25	Wagner	720
20	G.E.	1750
20	G.E.	1200
20	Cr. Wh.	1200
20	Al. Ch.	900
20	Diehl	900
20	G.E.	720
20	West.	1720

29—15 H.P. 4 speed 600/900/1200/1800 RPM Constant H.P. Motors

15	Cr. Wh.	1700
15	G.E.	1200
15	Wagner	720
15	G.E.	600
10	G.E.	720
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cent.	1165
7½	Cent.	3500

AC GENERATORS

150 KW G.E.	720
125 KW Cr. Wh.	900
100 KVA West.	600
60 KW West.	1200
125 KVA West.	1200

New York City's Largest Stock Electrical Machines

ESTABLISHED 1910

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Reading, Penna.
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York, Penna.
323 E. Market St.

SPECIALS

1000 Ampere 60 Volt
CHANDEYSSON
Synchronous Motor Driven
D.C. GENERATOR
450 RPM—3 ph 60 cy 220 Volt
Complete with starter & Panel Board

Also

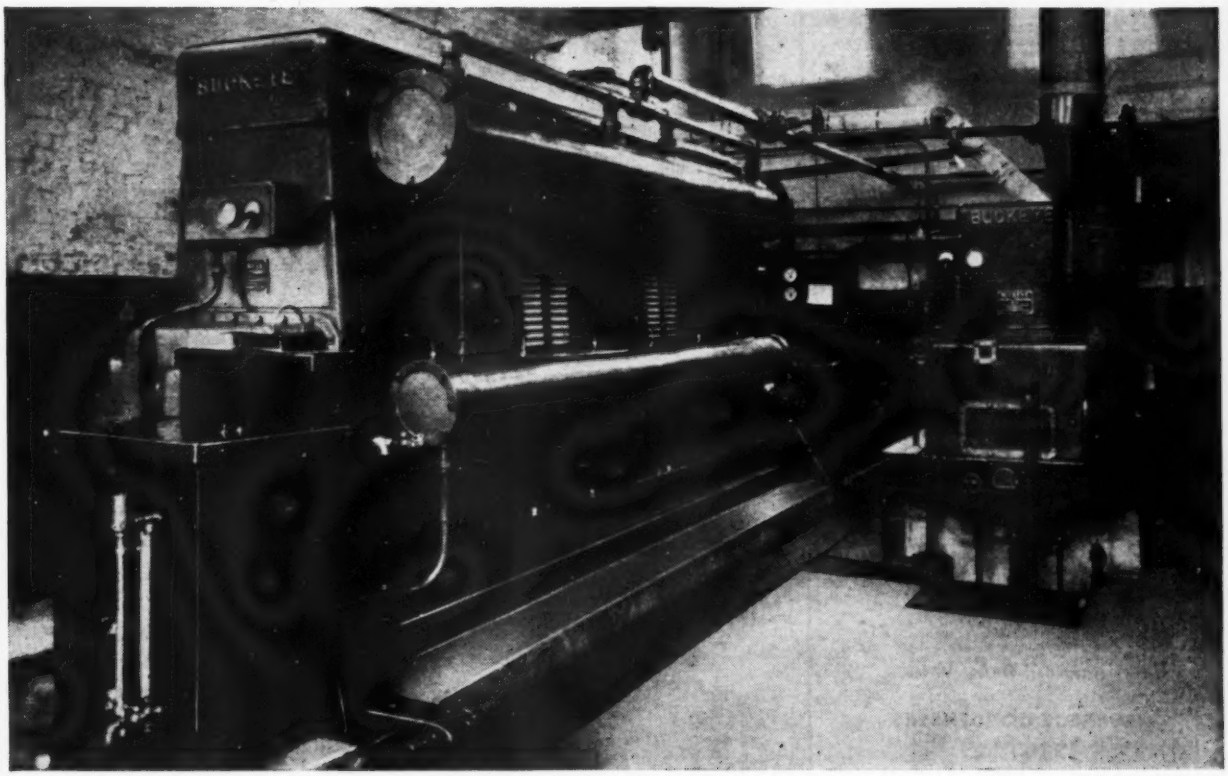
1000 ampere 6 Volt Plater
Chandeysson Synchronous
Motor Driven 600 RPM 3/60/220V.

2000 HP DIESEL PLANT

7 BUCKEYE DIRECT CONNECTED SETS

AVAILABLE TODAY

(SELL ONE OR ALL)



CONDITION GUARANTEED

This unusual offering consists of 7 modern BUCKEYE DIESEL ENGINES each direct connected to a 3/60/2300 volt generator with individual switchboard panels, voltage regulators and automatic synchrostats. Complete engine auxiliaries including air starting compressors, tanks and gauges, lube oil filters, circulating water pumps, fuel oil day tanks and transfer pumps. Engine and generator specifications are as follows:

1—675 HP Model 0 6 cyl. 13½ x 15½—D.C. to 450 KW Generator 360 rpm
1—290 HP Model 70 6 cyl. 10 x 12 —D.C. to 200 KW Generator 514 rpm
2—240 HP Model 70 5 cyl. 10 x 12 —D.C. to 150 KW Generator 514 rpm
1—190 HP Model 70 4 cyl. 10 x 12 —D.C. to 125 KW Generator 514 rpm
1—260 HP Model E 7 cyl. 9½ x 14 —D.C. to 175 KW Generator 400 rpm
1—150 HP Model E 4 cyl. 9½ x 14 —D.C. to 100 KW Generator 400 rpm

Running Inspection by Appointment

ROBERT SCHOONMAKER

DIESEL SALES ENGINEERS

P. O. BOX 232 PHONE ROSLYN 1220

PORT WASHINGTON, L. I.

NEW YORK

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 8250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 625 KVA General Electric Non-C.
1— 500 KVA Westinghouse Non-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 100 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D.C. STEAM ENGINE UNITS

1—425 KW Ridgway Slide valve 275 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West. (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—360 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop.-Bess., 216 V. gen.
1—145 HP Superior, 220 V. gen.
1— 57.5 HP Caterpillar, 120/208 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
1—812 HP Stirling 200-lb.
1—600 HP Union 250-lb., Stoker
5—600 HP B. & W. 200-lb., Stokers
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160-lb.
4—200 HP B. & W. 200-lb., Hand fired

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
1— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G. E. 25 cy. 13200-4000 V. 300 RPM
1— 800 HP G. E. 60 cy. 440 V. 120 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—1000 HP G. E. sq. cage 2300 V. 509 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 2300/4000 V. 1200 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC
2— 75 KW Westinghouse 125 V. DC

ROTARIES—60 Cy.

1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 750 KVA G. E. 230-460 V. 300 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

1—10000 KVA West. 120,000/66000-13200 V. 3 ph.
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000/33000 V.
3— 200 KVA G. E. 66000-13200/22800 V.
6— 250 KVA Penn. 34500-4600/2300 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 6000 KVA West. 13200-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
3— 833 KVA G. E. 22000-2300/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G. E. 22000-11000 V.
6— 1667 KVA Pitts. 13200-2300 V.
5— 1000 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-2300 V.
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3— 1250 KVA G. E. 6600-550 V.
3— 150 KVA Al. Ch. 2400/4800 V.

VOLTAGE REGULATORS
60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—48 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FKO36 Outdoor
1— 400 A. 73 KV G. E. FHKO36 Outdoor
1— 800 A. 37 KV G. E. FHKO136 Outdoor
6— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV. Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
4— 600 A. 15 KV G. E. FKO60B Outdoor
2— 400 A. 15 KV G. E. FHKO136 Outdoor
2— 600 A. 25 KV West. B-13 Indoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
2—1500 A. 15 KV G. E. FK12 Indoor
3— 600 A. 15 KV G. E. FK32G Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor
2—1000 A. 4.5 KV Condit D-12 Indoor

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BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY 7, NEW YORK

PARTIAL LIST OF OUR COMPLETE STOCK FOR IMMEDIATE SHIPMENT

PUMPS

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif.
6000	33'	LeCourtenay	Centrif.
3500	140'	Kingsford	Centrif.
2500	150'	Goulds	Centrif.
1000	147'	Allis-Chalm.	Centrif.
1500	180'	Penna.	Centrif.
400	625'	LeCourtenay	Centrif.
250	325'	LeCourtenay	Centrif.
300	500'	Goulds	Triplex
175	500'	Worth.	Teiplex
500	175'	Blackmer	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
300	175'	Blackmer	Rotary
1000	460'	Knowles	Steam
500	460'	Knowles	Steam
2000	50'	Lawrence	Sump
300	251'	Gardner	Plunger

GENERATOR SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
251	Green Eng.	220	Belt Drive
100	Ames	240	dir. dr. Eng.
75	Ames	240/120	dir. dr. Eng.
17	Sturt. Turb	110	Direct Drive
7½	Sturt. Turb	110	Direct Drive

MOTORS (D. C.)

100 Northwest 220 1750
25 Imperial 220 450

STORAGE TANKS

5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 25000EDR
Nash-Jenn Sump Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ind. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
220	100	Gardner	Gas Eng.
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2¼ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100-60000	¼"-5"	Buffalo	Various
100-15000	¼"-16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Dir. dr.
110	15 lbs.	Beach R.	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth.	Belt dr.
100	high vac	Beach R.	Gear dr.
100	27 in.	Deane	Belt dr.
300	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn.
175	G.E.	440	1150	I
125	G.E.	220	1150	Vertica
100	Lincoln	220	1750	
60	Wagner	220	850	Syn. 2 ph
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	870	CS
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	sl. rg.
30	Wagner	220	1150	

STEAM ENGINES

Turb. Cent. Bronze Pumps
Valves—Reducing Valves
10"x10" Greenfield Vertical
7"x7" Wicket Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.

140 Grand St., N. Y. C. Tel. CAnal 6-6983-4

REBUILT POWER EQUIPMENT

READY TO SHIP!

MOTOR GENERATOR SETS

1—150 KW Ridgway 250 v. 900 rpm. 2200 v. 3 ph. 60 cy. syn.
1—300 kw. West. 550 v. DC 1200 rpm. 2200 v. 3/60 complete with AC and DC swb; also automatic reclosing circuit breaker.
1—1000 kw. G.E. M.G. Set 2300 v. AC, 250 v. DC, 720 rpm.

SLIPRING MOTORS—3 PH., 60 CY.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
20	Cr. Wh.	220	850	
20	C.F.	220	1200	MT
40 to 50	Westg.	440	1150	CW
50	G.E.	220/440	1160/580	CM-7
50	Westg.	440	1150	CW636A
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	G.E.	220/440	1200	HI
50	Allis Chal.	220	490	
62	Westg.	220/440	1135	
75	Westg.	220/440	690	CW
100	Westg.	2200	900	CW
100	G.E.	2200	450	I-M
100	Westg. (Ball Bearing)	220	720	CW-854
150	G.E.	220	375	I-8
185		2300	900	
200	Westg.	220/440	580	CW
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
300		2300	720	
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
600	G.E.	550	150	I
600	G.E.	2200	600	MT-12
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
30	G.E.	220 only	900	I
30	Linc. Elec.	220	600	
30	Duquesne	440	600	
30	Allis Ch.	220	900	
30	Triumph	220	525	TR-138
30	Western	220	900	
30	Allis Chal.	220/440	1200	
30	G.E.	220/440	900	KT-532
30	G.E.	220/440	1750	KF
35	West.	220/440	1200	CS
35	Lincoln	220	720	
35	G.E.	440	1200	I
35	Al. Ch.	550	1200	
40	Powell	220	900	SO
40	Reliance	440	900	
40	Linc. Elec.	220	900	
40	Westg.	440	900	C
40	Westg.	440	600	C
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
40(New)	West.	220/440	1800	CS
40	G.E.	220/440	1200	KT-532
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	Westg.	440	1800	C
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Duquesne	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	G.E.	220/440	1200	HI
50	Westg.	440	690	C
50	Allis Chal.	2200	865	
50/32	G.E.	440	800/640	
50/60	G.E.	440	1200	I
54	Allis. Chal.	440	900	
60	Westg.	440	1800	C
60	Duquesne	440	1800	
60	Al. Ch.	440	1200	
60	Westg.	220	720	CS
60	Allis Chal.	440	1800	AN
75	West.	220/440 (Linestart)	3550	CS-W445S
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	West.	2220/220/440	720	CS
100	Allis Chal.	220	1750	
100	G.E.	2200	450	I
100	Allis Chal.	220	600	
100	G.E.	440	400	I-K
125	West.	2300	1170	CS
125	G.E.	440	450	I
125	G.E.	220/550	400	I
150	West.	220/440	327	Syn.
150	Wagner	440	1800	31V
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	575	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
50/150	West.	2200/440/220	360/720	CS
(Complete with Niles Speed Reducer, ratio 10:1)				
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/500	514	I
400	West.	2200/220/440	500	CS
500	G.E.	220/440	1170	KTP-567
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
3500/4000	West.	4000/23000	900	Syn.
9000	G.E.	6600	107	ATI

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2½	West.	600/1200	SK-30
2¾	Westg.	900/1800	SK
3	Janta-Liest	650/1950	BI-DC
3	Westg.	450/900	SK
3	Roth (Enclosed)	500/1000	RS
3	West.	650/1950	SK-33
3	West.	850/1700	SK-33
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5	Allis Chal.	450/1800	E-90
5	Reliance	300/1800	21
6	Roth	500/1000	RS
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SK-100L
7½	West.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
10	West.	400/1600	SK-100L
10	West.	850/1700	SK-70
10	West.	500/1000	SK-70L
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	West.	675/1350	SK-100L
20	West.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri.	Sec.	Ph.	Make
15	5	220		110	G.E.
45	5	1100/2200		122/244	G.E.
21	5	2200/1100		110/220	West.
87	5	2200/1100		110/220	G.E.
101	7½	2200/1100		110/220	G.E.
43	7½	2200/1100		110/220	West.
50	7½	1100/2200		122/244	G.E.
27	7½	220		110	G.E.
30	7½/10	440		110/220	G.E.
19	10	2200/1100		110/220	West.
48	10	2200/1100		110/220	G.E.
42	10	1100/2200		122/244	G.E.
45	10	220		110	G.E.
2	15	400/30000/50000			Amer.
45	15	440		110/220	G.E.
15	15	4160		110/220/440	G.E.
12	15	2200		110/220/440	G.E.
27	20	2200		110/220/440	G.E.
30	20	4160		110/220/440	G.E.
1	25	460		180	Pgh.
1	25	1100/2200		110/220	G.E.
1	37½	2300		110/220	Wag.
3	50	6600		575	G.E.
3	50	6600		575/440/220	G.E.
4	50	6600		575/440	Allis.
4	60	11430/6600		550	Al Ch.
6	73	440		220	West.
6	73	440		205	West.
1	75	2200		220—3 ph.	Burke
3	100	6600		220/440/550	Pgh.
1	100	2200		110/220—3 ph.	G.E.
1	140	2300			
	Furnace Trans. 60-80 and 100 v. taps.				
1	150	220		110/220	G.E.
1	200	2200		110/220	G.E.
1	250	11000/22000		110/220/440	Pgh.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.
1—2000 lb. Elwell Parker lift Truck, 7'6" lift, 9'4" overall height, 10' length.
1—4000 lb. Yale Electric Industrial Truck, model K-22A.

CHAIN BLOCKS—with or without trolleys

2—Chisholm Chain Blocks 2 tons
2—Ford Triblock—2 ton
4—Ford Triblock—3 ton
1—Phila.—3 ton

HOISTS

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

INDUCTION MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220/440
25	Westinghouse	1150	220/440/550
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
30	West.	1150	220/440
35	G.E.	1150	220/440
35	Westinghouse	850	220/440
40	West.	1150	220/440
90	Reliance	1150	220/440
110	Crocker Wheeler	720	2200/440/550

COAL CONVEYOR

Link Belt Vertical Coal Conveyor, bucket type, approx. 80 ft. good for 100 FPM, hoists 25 TPH, all new buckets and gears complete with 20 HP AC motor.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

GEAR MOTOR

20 HP Louis Allis Gear Motor, 220/440 v. 3 ph. 60 cy. 1750 rpm. with speed reducer motorized planetary speed reducing transmission, driven speed approx. 14 rpm. totally enclosed, fan cooled.

A.C. GENERATORS

125 KVA West., 220/220/440 v., 3 ph., 60 cy., 327 rpm.
150 KVA Wagner, type BF, 600 rpm., 400 v., 3/60
250 KW Al. Ch., 480 v., 150 rpm., 3 ph.
360 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

SPEED REDUCERS

H.P.	Make	Ratio	R.P.M.
1	Boston	30:1	720
2	Boston	30:1	900
2½	Link	221:1	580
3	Link	221:1	720
3	Link	221:1	1100
3	Link	221:1	870
3	Link	221:1	870
3	Boston	30:1	1200
4	Link	221:1	870
5	Link	221:1	1150
5	Boston	30:1	1800
7	Link	221:1	1750
15	Link	24½:1	500
20	Link	24½:1	680
25	Link	24½:1	870
25	W. A. Jones	9.143:1	300
30	Link	24½:1	1130
30	Link	4.33:1	500
35	Link	24½:1	1750
40	Link	4.33:1	720
40	W. A. Jones	9.143:1	480
50	Link	4.33:1	870/1150/1720
50	W. A. Jones	9.143:1	575
50	Niles	10:1	
50/150	Niles	10:1	360/720
75	W. A. Jones	9.143:1	875
75	Niles	10:1	350
100	W. A. Jones	9.143:1	1150
100	Niles	10:1	550
125	Niles	10:1	600
150	Niles	10:1	720
175	W. A. Jones	9.143:1	1750
200	Niles	10:1	860
225	Nuttal	1.6:1	
300	Niles	10:1	1150
300	Nuttal	1.6:1	
400	Niles	10:1	1750
400	Nuttal	1.6:1	

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS — METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS — REACTORS.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.
LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC & MFG. CO.
PITTSBURGH 6, PA.

1—502 HP Stirling Type Babcock and Wilcox Boiler, Class 0-20, National Board 200 lb. pressure complete with superheater and motor driven pulverizer.

Nelson Machinery Company
119-125 North Pearl Street
Green Bay, Wisconsin

SPECIALIZING Right Now in Factory Rebuilt Pumps!

Centrifugal, Steam and Power Pumps.

In writing, state conditions fully. We can also furnish NEW pumps within approx. 3 to 4 weeks!

We buy pumps. Dealer co-operation.

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724 W. GAY ST. Columbus 8, Ohio

FOR SALE — PULVERIZERS

2—Aero Foster Wheeler Size F 5000# Coke per hour each, with 50-H.P. Ty F.T. G.E. Motors 440-volt 60 cycle 95% New $3,750.00 each.

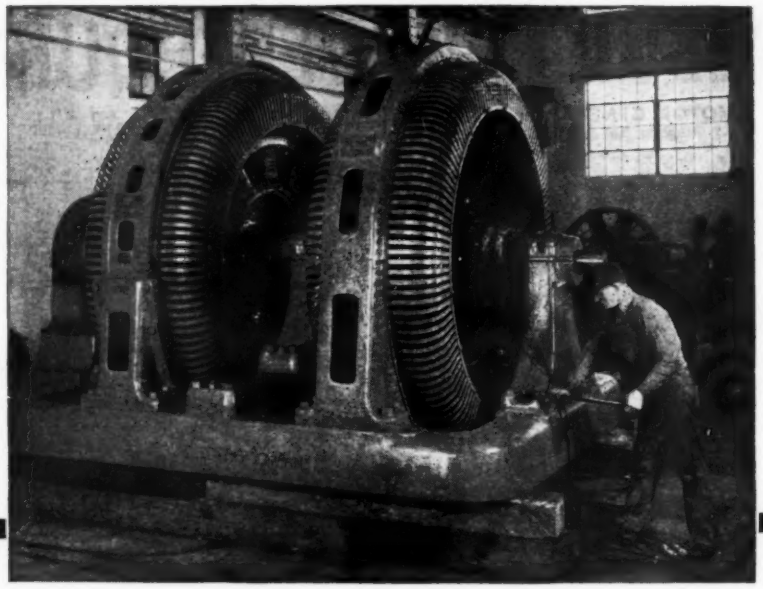
BEVIS MACHINERY COMPANY
585 S. Santa Fe Ave. Los Angeles 13 Cal.

Chicago Electric Offers

GUARANTEED REBUILTS

From An

UNSURPASSED STOCK!



Experienced buyers of rebuilt power equipment look for two things of prime importance . . . One—a company sufficiently skilled in rebuilding to offer completely guaranteed units . . . And two—an organization geared to supply almost any rebuilt unit *from stock.*

Chicago Electric offer rebuilt units with performance guaranteed "same as new" . . . And, the Chicago Electric stock is one of the most complete in the nation. The 1400 HP General Electric Frequency Changer shown above is an example of the quality rebuilding done in our shops . . . Investigate!

New 42 page illustrated stock listing just off the press is available free upon request. Send for your copy now!

CHICAGO ELECTRIC CO.

1320 W. CERMAK RD.
CHICAGO 8, ILLINOIS

BOILERS

1—1260 HP **B&W Sectional Header Boiler,** 250# pressure, underfeed stoker.
1—400 HP **Combustion Engineering,** 350# pressure, water-wall, Type E **Stoker.**
1—250 HP **Casey-Hedges,** 160 lb. pressure.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen Boiler,** 354# pressure.
1—357 HP **Heine** with Riley Underfeed Stoker.
3—253 HP **Vogt** low head **Boilers,** 225# pressure with oil burners, all auxiliaries. New in 1937.
2—300 HP **Heine** 175# pressure.
2—250 HP **Wickes vertical boilers,** powdered fuel.
6—600 HP 200# pressure **O'Brien** boilers.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
1—585 HP **Erie City** vertical boiler 185# pressure, Type E stoker.
1—600 HP **Union Iron Works** 250# pressure **Chain Grate Stoker** new in 1936.
1—444 HP **Union Iron Works Boiler,** 225# pressure.
2—500 HP **Edge Moor Boilers** 200# pressure.
1—600 HP **Union Iron Wks,** 250# **pressure boiler,** chain grate stoker. New 1935.
1—624 HP **Edgemoor Boiler,** 200# pressure, underfeed stoker.
1—522 HP **Sterling Boiler,** 200# pressure with **Firite Stoker.**
1—640 HP **Heine Boiler,** 199# pressure.
1—484 HP **Springfield Boiler,** 250# pressure oil burners.
2—512 HP **Stirling** 200# pressure, completely rebuilt.
2—350 HP **Stirling** boilers with auxiliaries.
1—250 HP **Heine** boiler, underfeed stoker.
8—150 HP **HRT Boilers,** 150# pressure.
1—175 HP **Water Tube Boiler,** 160# pressure.
4—1010 HP **Heine** watertube boilers 250# pressure.
1—400 HP **Connolly Boiler** 160# pressure with new tubes and auxiliaries.
4—72" x 18' **HRT** boilers including a 637 KVA General Electric condensing turbine. Complete plant.
1—150 HP **HRT,** 125# pressure, rebuilt and guaranteed.
2—175 HP **Brownell HRT Boilers,** 150# pressure, rebuilt.

TURBINES

2—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts **Surface Condenser,** all auxiliaries.
1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine,** with auxiliaries.
15,000 KVA **Westinghouse** turbine, condenser.
1—1000 KW **Westinghouse non-condensing turbines** 350# pressure, 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr** Non-condensing 3600 RPM.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—375 KVA **Waite Non-condensing turbine.**

ENGINE GENERATOR SETS

1—340 KVA **Skinner** Uniflow Engine Generator set with panel board.
2—200 KW 250 volt D.C. **engine generator sets.**
1—250 KVA **Ridgeway** engine generator set.
1—500 KVA **Allis-Chalmers** Corliss.
17 inch by 18 inch **Skinner** uniflow engine.
1—166 KVA **Ames Uniflow engine generator set.**
1—260 KVA **Skinner** uniflow engine.
1—625 KVA **Bates Corliss** engine.
1—7 ft. diameter by 175 ft. self supporting stack.

DIESEL ENGINES

1—200 KVA **Fairbanks-Morse** Full Diesel **Engine Generator.**
1000 KVA **Diesel** Generator Plant complete.
1—**Busch Sulzer** Full Diesel direct connected 1335 KW AC **generator,** rebuilt and guaranteed.
1,250 KVA **Nelesco** engine generator.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1060 KVA **Nordberg** Uniflow **Engine Generator.**

MISCELLANEOUS

54,000 pound **Cochrane** hot process lime and water softener.
2500 HP **Cochrane** Open Feed Water Heater.
1—10' x 15' **Illinois** Forced Draft Chain Grate Stoker.
2—6 **Retort Taylor Stokers.** First-class condition.
1—8 **retort Taylor,** brand new stoker.
1—800 HP **Hoppes** open feedwater heater.

SEE Fletcher FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM
200 KW RW SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

COMPRESSORS

526 CFM Ingersoll Rand, Style "J"
940 CFM Ingersoll Rand, Type 10 horiz. 2 st., steam driven, with receiver

CRUSHERS

24" x 54" Superior Crushing Rolls
#3 and #6 McCully Gyratory

HOISTS & HOIST MOTORS

(Write for our complete list)

PUMP, Centrifugal

300 GPM, 50' head, 1750 RPM

SHOVELS

#2 Koehring 3-way combination Crane, Dragline & Shovel
320-B, 6½-yd. Electric Stripping

TRACTOR WAGONS

7, 7½ yd. cap. Allis Chalmers Speed-Ace Tractor Wagons—Request bulletin!—

TANK & TOWER

60,000 gallon Water Tank on 89'9" tower, with 10" riser pipe

IRON & STEEL PRODUCTS, INC.

13438 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

PIPE

CUT TO SKETCH ⅛ to 24"

METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 EAST 31st STREET, N.Y.C.
HOURLY NATON-WIDE SHIPMENTS
Phone MUrray Hill 3-3408

FLANGED VALVES & FITTINGS

A. C. GENERATORS

10—62.5 KVA General Elec. 220/127 Volts Type ATI, 3 ph. 60 cyc. 80% P.F. 1200 R.P.M. Revolving Field with Exciter.
8—37.5 KVA General Elec. 220/127 Volts Type ATI 3 ph. 80% P.F. 1200 RPM Revolving Field with Exciter.
5—25 KVA General Elec. 220/127 Volts 3 ph. Type ATI, 80% P.F. 1200 RPM Revolving Field with Exciter.
10—18.75 KVA General Elec. Type ASI. 120/240 Volts, 1 ph. 1200 RPM, 80% P.F. Revolving Field with Exciter.

WURTH ELECTRIC MOTOR CO.

Motors, Generators, Alternators, Frequency Changers

141 GRAND STREET NEW YORK CITY
Tel. CAnal 6-6138

1—400 HP Westinghouse, type CW, 3 ph. 60 cy, 440V, 450 RPM slip ring motor
1—250 HP General Electric, 3 ph, 60 cy, 440V, 1-17 400 RPM
1—150 HP Electric Mach. syn. motor, 125 KVA, 3-60-220V, 1200 RPM
1—150 HP General Electric, 3-60-440V frames 17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring
4—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring
2—100 HP General Electric type I, form K, 3-60-220V 575 RPM

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse, type SK, frame 666.3, 600 V, 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring
1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter
2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring
1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage
2—75 HP 300 foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3 ph, 60 cy, slip ring motors direct connected to 500 GPM 3 stage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring
1—75 HP Western Elec. type I, 3-60-440V, 690 RPM
2—75 HP Allis Chalmers, 3 ph, 60 cy, 440V, 860 RPM slip ring
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP Westinghouse, 3 ph, 60 cy, 220V, 1160 RPM, type CS-644C
1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 48, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Howell, 3 ph, 60 cy, 440V, 1165 RPM, type SC50-4, ball bearing
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM sq. cage
1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 2220V, 3600 RPM, type HO, frame 12B ball bearing

2—drag generators, 15 KW, Westinghouse, SK111, 125 V, 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM
2—40 HP C & C 230V, 250/1000 (planer)
2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring
1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS. Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA G.E., 2300 V. cond.
3125 KVA G.E., 4100/2300 V. cond.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. Cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V.
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
750 KVA G.E., 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal. 480 V. BLEEDER.
150 KVA Wghse. 240 V. cond.

(NON COND.)

500 KVA Wghse 480/240 V.
125 KVA G.E., 480/240 V.
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
175 KVA Al. Chal.—Sturtevant 220 V.
75 KVA Al. Chal. 240 V.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
600 HP Connelly, 200#
522 HP Kidwell 207#, 3 drum.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#.
287 HP (2) B&W 160#
259 HP (3) Wicks ver.; 160# pulverizers.
250 HP Sterling, 160#
200 HP (2) Scotch Marine, 15#
153 HP (2) Union I-Wks 160# (stokers)
Two 78" x 18' HRT 125# pulverizers.

DIESEL ENGINE SETS

500 KVA Wghse.—Busch Sulzer
375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
200 KVA G.E.—Busch Sulzer
170 KVA F.M.—F. M. "VA"
140 KVA E.M.—Fairbanks Morse "V"
125 KVA Ideal-Primm
105 KVA Ideal-Primm
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

DIESEL ENGINES

240 HP Fairbanks 35-E 6 cyl.
225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

SPECIAL

3125 KVA G.E., 480 V. condensing Turbo hoist, auto extraction.
750 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
522 Kidwell 207# with Fire-rite stoker.

STEAM ENGINE SETS (A C)

675 KVA Burke—24 x 36 Nordberg Unif.
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
325 KVA A.C.—21 x 22 Skinner-Unif.
210 KVA G.E.—19 x 20 Skinner Unif.
150 KVA G.E.—16 x 15 Skinner Unif.
150 KVA G.E.—16 x 16 Skinner S.V.
125 KVA G.E.—12 x 21 Hamilton, 4 V.
100 KVA G.E.—14 x 15 Skinner Unif.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head.
7500 GPM 80' head
5500 GPM Buffalo 50' head.
4000 GPM 70' head
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
1200 GPM Al. Chal. 65' head.
1080 GPM Morris 255' head.
850 GPM 243' head
750 GPM Hill 231' head
350 GPM 720' head

STEAM ENGINE SETS (D C)

450 KW C. W. 250 V.—Nordberg Unif.
400 KW G.E.-Ridgway 4 V.
300 KW G.E.—Skinner Unif.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
500 CFM Ingersoll 100#—Motor
"Steam and Gas Driven"; all sizes

TRANSFORMERS

687 KVA (2) Maloney 13800-460 V.
500 KVA (3) Al. Chal. 33000-440 V.
500 KVA (2) G.E. 6600-2300 V.
500 KVA (2) G.E. 11900/6900-230/460
333 KVA (3) G.E., 13800—320/460
250 KVA (2) G.E. 6600-2300 V.
150 KVA (5) G.E. 2300-120/240
100 KVA (3) G.E. 13200-2300
100 KVA (3) Al. Chal. 22000-440 V.
100 KVA (2) G.E. 13200/6600-440/600 V. & small sizes.
3 Ph. Transformers
750 KVA Wagner 6600-2200 V.
500 KVA (4) G.E. 13200-120/208 V.
300 KVA (2) G.E. 13200-120/208 V.

TURBO GENERATORS

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs. pressure, 125° Superheat, complete with condenser, Pump and Air Washer. Generator: 6250 KVA 3 Phase 60 Cycle 2300 Volt 3600 RPM with turbo exciter and Motor Generator Exciter.

West. 75 H.P. Turbine non condensing 200 lb. pressure 7200 RPM connected thru reduction gear to 50 KW 125 volt D.C. Generator 1200 RPM.

1—750 KW Ridgway Elliott-Turbo Set mixed pressure 1800 RPM 230 Volt DC.

MOTOR GENERATOR SET

50 KW West. SK150L—1200 RPM 125 volt D.C. connected to 75 HP CS 764—2200 volt 3 phase 60 cycle 1200 RPM motor.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass. complete with pumps.

• STOKERS •

2—440 H.P. New Westinghouse single retort moving grate stokers, complete with hydro feed drives, blowers and all accessories. Will operate at 200% of rating. Never installed. Priced right for immediate sale.

BOILERS

4—1010 HP Heine Watertube Boilers, pressure 250 lbs., complete with Superheaters, Bethlehem Dahl Oilburners, all valves, Piping and fittings.

2—316 HP Heine Watertube Boilers 160 lbs. pressure.

2—684 HP Edgemoor Waste Heat 200# pressure ASME with superheaters and economizers.

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CENTRIFUGAL PUMPS

2—Lecourtenay 5" all bronze centrifugal pumps 500 GPM at 90' head direct connected to Allis-Chalmers 20 H.P. Motor 440, 60, 3, 1740 RPM.
2—Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pumps, type 12BT8, 5,000 GPM at 148' H., Direct connected to G.E. 250 HP. Motor, type 1E15, form K, 440, 60, 3, 1760 RPM.
Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pump, 4,500 GPM at 135' H. 1750 RPM Direct Connected to Allis-Chalmers 200 H.P. Motor 440, 60, 3, 1750 RPM.
8—Gould Centrifugal Pumps 270 GPM, 30' H. Direct Driven by 5 H.P. A.C. Motor.
Cameron Centrifugal Purchased New 1923. Bronze fitted, mounted on common subbase for motor drive—
1—Size 14—700 RPM 4700 GPM 35' head 60 H.P.
1—Size 14—720 RPM 5500 GPM 38' head 75 H.P.
1—Size 16—350—RPM 3500 GPM 45' head 125 H.P.
All Pumps Tested Hydrostatically for 125 lbs.
All Double Suction Volute, Gate Valves Attached.
1—Gould Triplex Pump 5 x 8.

MISCELLANEOUS

3—100 KVA Pittsburgh 2400/240/120 oil.
4—5 KVA Wsghse. 2300/230/460 air.
FEEDWATER HEATER: 5,000 HP. Cochrane open type.
50 KW Westnghs. 125 V. DC. 900 RPM. direct conn. to 75 HP. 440-3-60 Motor.
OVERHEAD CRANES: One 25 Ton overhead hand-operated.
One 15 Ton overhead 50' span traveling crane, electric lift; hand travel.

HEAT and POWER Company

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Units Available For Current Emergency and Post-War Plans at Fair Values

STRAIGHT TUBE & STIRLING BOILERS

4—1000 HP Box Steel Header Straight tube Longitudinal Type 250# ASME 125 deg. super heat, oil fired.

1—850 HP—250# Edgemoor with all auxiliaries and stoker.

1—612 HP Stirling 200# ASME complete with stoker, all aux.

5—588 HP B&W water-tube 200 plus # with Taylor stokers.

3—559 HP Stirlings non code 150# allowed.

2—512 HP B&W Stirlings 205# & 160# with new tubes.

2—400 HP Stirling B&W ASME 185# now allowed.

1—400 HP—350# Combustion Eng. boiler with Comb. Eng. stoker.

A Comprehensive list of good boilers at Fair Prices on application. Other complete units and auxiliaries in all sizes AT NEW AND FAIR PRICES.

TURBINES—60 Cyc.

1—5000 KW Westinghouse, 60/3/2300V—200# 78CW frame complete with all aux. LeBlanc condenser—a rare offering.

1—5000 KW Wemco, 60/3/2400V—200#, (condenser-turbo renewed to date), 100 deg. super ht, 2# back press.

1—4000 KW Westinghouse Wemco. 60/3/3/2300V 3600 RPM turbo gen. condenser equipped.

1—5000 KW/6250 KVA Curtis GE Multi stage condensing; 220/225#, 125° superht. with surface or jet cond.

1—2500 KW GE Curtis 4 stge-cond. 60/3/4100 star-delta 2300V; 200#; 100° superht with surface condenser.

1—2000 KVA Wemco turbo—170#; 5# back pressure 60/3/460V with 3000 sq. ft. Wheeler type condenser all pumps & aux.

1—1000 KW Westinghouse Non Cond. 150/200#, 15# gbp. 60/3/2300V.

1—750 KW GE Alternating Curtis 3 stage condensing turbo 150; 3600 RPM with: sync conv. 900 speed; DC amp. 3000, volts, 250 multi jet cond. exciter; Delaval 1800 GPM pump & turbine.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

Rebuilt Motors

3 PHASE, 60 Cycle, 220/440 Volts

HP	Make	Type	RPM
400	General Electric	I-K	900
400	General Electric	I-K	900
350	General Electric	I-K	900
250	General Electric	I-K	900
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	I-K	900
200	General Electric	I-K	720
150	General Electric	KT357	1200
150	Westinghouse	CCL	900
125	General Electric	KT347	1800
100	General Electric	KT347	1200
100	General Electric	KT347	1200
100	General Electric	KT353	1200
75	General Electric	KT543	1800
75	General Electric	KT343	1800
60	General Electric	KT343	1200
60	Burke	EM7	870
60	General Electric	KT346	900
60	General Electric	KT346	900
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	General Electric	KT327	1800
50	Westinghouse	CS-646A	870
50	Reliance	IJ	1800
40	Westinghouse	CS	1800
40	Westinghouse	CS	1800
40	General Electric	KT323	1800
40	General Electric	KT323	1800
40	General Electric	KT523	1800
40	Burke	EM45	1200
35	Lincoln	D-411	1800
30	Westinghouse	CCL	720
30	General Electric	KT332	1160
*30	Armor	A	850
25	General Electric	I	1150
**25	Westinghouse	CS-444	870
*20	Armor	ET-416	850
*20	Fairbanks Morse	H	900
*20	General Electric	KG-405	880
20	General Electric	KG-404	1150
20	General Electric	KT312	720
20	Fairbanks Morse	H-12A	850
15	Westinghouse	CS371C	1800
15	Westinghouse	CS371C	1800
15	Crocker Wheeler	1100	560
15	Crocker Wheeler	114Q	1800
10	Star	AX	3500
10	Century	SC	685
10	General Electric	K-404	700
10	General Electric	KT312	900
10	Lincoln		1200
7½	Fairbanks Morse	B	1200
7½	General Electric	KT	1200
7½	Wagner	14VBP	1800
5	Westinghouse	CCL	3400
3	U. S.	FRB	1800
3	Fairbanks Morse		900
*1	Master	PA	3425
1	Allis Chalmers	AR	1800

If You Use 25-CYCLE MOTORS

write for our

NEW LIST

from plants just purchased

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist storage capacity for 11,000 feet 1" Rope—Speed 900' per minute.
Motor 500 HP Gen. Elec. Mt. Silpring 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.

Write Wire Phone

SLIPRING MOTORS

60 Cycle—3 Phase—220/440 Volts

HP	Make	Type	RPM
500	Westinghouse	CW	575
400	General Electric	I-M	900
250	General Electric	I-M	900
250	Allis Chalmers		505
200	General Electric	I-M	900
75	General Electric	MT-546	900
50	Westinghouse	CW	700
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748A	690
40	Wagner	22WB	540
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
30	Westinghouse	HF	1745
*20	Westinghouse	CW-644C	575
20	General Electric	MT-332	545
15	General Electric	I-M	900
15	General Electric	MT-322	855
13	Sachsenwerk	D7318	850
11	General Electric	ITC-5008	820
10	General Electric	MT-303Y	1800

* Ball bearing. ** Sealed sleeve bearing.

MOTORS

25 cycle—3 phase—2200 volts

100 H.P., General Electric, type KT558, 750 rpm, serial number 5227257, ball bearing.
100 H.P., Allis Chalmers, type AR, ball bearing, 1500 rpm, serial number 42209K426N-1-1.
150 H.P., General Electric, ball bearing, type KT557Y, 1500 rpm, serial number 5269756.

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.

1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 3625/440 V. Complete with exciters and panels.

200 KW., 25 CYCLE, M. G. SET

200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC, on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

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A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

1—6250—KVA. G.E. 3/60/2300V. 200#
1—3125—KVA GE 3/60/2300V. 200#
2—1875—KVA GE 3/60/2300V. 200#
1—1000—KW. DC. West. 3/60/250; 135/200#
1—1563—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3/60/2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3/60/2300:200#
1—250—KVA GE. Non-Cond. 3/60/480

Also Any Capacity or Type Desired.

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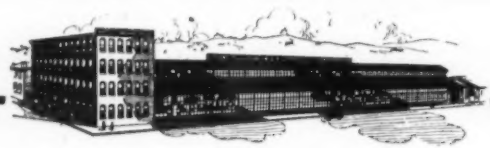

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1—3000 amp 3 pole 600 volt type FK25 General Electric
2—400 amp 3 pole outdoor type FHKO136 General Electric
1—800 amp 3 pole type B20 outdoor with house
10—1200 amp 3 pole FK32B General Electric

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Motor Generator Sets—Synchronous Motors, Etc.

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1—West. 500 KW 275 or 600 Volt D.C. 720 RPM, 2300 Volt 80% P.F. 720 HP A.C.

VERTICAL MOTORS

1—G.E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS 3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 250 HP 600 RPM 440 Volt 3-bearing
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt

G.E. 62½ HP 1150 RPM 440/220 Volt

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20—Clark Bulletin 5370 30 HP 230 Volt D.C. automatic starters—none used over two months.

A large number of adjustable speed D.C. motors from 5 to 150 HP

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 cycle

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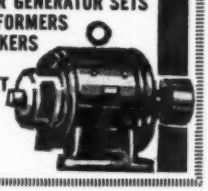

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Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries—also boilers, steam engines, turbo generators.

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New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.

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Transformer Specialists
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SEARCHLIGHT SECTION

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
800	2300	Whse	514
450	2300	G.E.	600
400	2300	Whse.	1200
350	220–440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2200	G.E.	1800
150	550	G.E.	720
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS

3-PH., 60-CY.

600	2200	Whse.	900
350	440–220	G.E.	900
300	440–220	Al. Ch.	600
200	2300–4000	G.E.	1200
110	440	Whse.	900
100	2200–550	Al. Chal.	1800
75	440–220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

OUTDOOR OIL CIRCUIT BREAKER

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva., Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-460/230
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTP	1200
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw. 125 v., 1200 rpm, Whse., conn. to 220 hp, 440/220 v., 3 ph., 60 cy., syn, very modern, practically new.
75 KW, 125 V, 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW 250 V, 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2200 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

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Power Plant Equipment

BOILERS and STOKERS

4—500 H.P. 1—440 H.P. 1—524 H.P. Cross drum type B & W Boilers 200# Pressure.
1—183 H.P. 150# Bigelow Boiler.

74 Steam motor & turbine driven pumps for all purposes. Duplex & single acting—large number of motor driven pumps of various pressures up to 6200 G.P.M.

TURBO GENERATORS

1—500 KW G.E. 200# pressure 3 phase 60—2400/480/240 volts condensing. Exciter on shaft 15.6 KW per hour water rate-operating panels and pumps etc. 4 years use—high serial numbers. Other units up to 12500 KW. 1—2500—2—2000—1—1250 KW. 1—50 KW.

Transformers up to 5000 Kva.—3—2500 Kva.—9—300 Kva., 3—500 Kva. Number of smaller sizes.

Assortment of G.E. Flow Meters complete with boards, instruments.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, etc.

We also buy complete plants outright. What have you for sale?

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Reconditioned Motors, Generators, Control Equipment, etc.
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1—4000 KW GE Cond. 2300 V.
1—3000 KW GE Cond. 600 V.
1—1250 KW West Cond. 440 V.
1— 750 KW West Cond. 6600 V.
1— 600 KW GE Cond. 600 V.
1— 500 KW GE Cond. 600 V.
1— 500 KW GE Cond. 125 V. DC.
1— 400 KW West Non-Cond. 480 V.
1— 200 KW GE Cond. 2300 V.
1— 100 KW GE Cond. 600 V.
1— 75 KW GE N.C. 125 V. DC.

Turbines Only

1—210 HP Terry 250#
1—175 HP GE 110#
1—225 HP Terry with gears

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3—318 HP Manning Type 170#
1—300 HP Heine 250# Stoker
1—150 HP HRT 150# Grates

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1—1214 CFM 100# Motor Driven
2—384 CFM-IR-Model 75M Air cool-Built-in Motor 440V
1— 386 CFM I.R. Steam Driven

Centrifugal Compressors

10000 CFM 33# Turbine Driven

Pumps

2—300 GPM 65' Hd. Motor Driven
1—1500 GPM Fire Pump Steam
1—1000 GPM Fire Pump Steam

Engine—Generators

1—600 KW GE 2300 V.

Miscellaneous

1—4100 Sq. Ft. 2 Pass Surface Condenser
3—Sets of 78" Perfection Stokers for 84" HRT Boilers. New 1943

Also transformers, engines and cranes

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The Buyer Must Be Satisfied—Always

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

SPECIAL OFFERINGS

4—1000 HP Heine 225# Boilers
2— 750 H.P. Edge Moor 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
2—570 H.P. B. & W. Sectional 200#, with Stokers
1— 600 H.P. B. & W. Stirling 200#, with Stoker
5—590 H.P. B. & W. 200# with Stokers
6— 440 H.P. B. & W. Sectional 200#, Oil fired
1— 335 H.P. B. & W. Sectional 200 Boiler
Smaller Boilers and Fire Tube Boilers also

1—5000 KW., G.E. Co., Turbo-Generator Condensing
1—5000 KW., W. E. & M. Co., Turbo-Generator Con.
1—3200 KW., Allis-Chal., Turbo-Generator Con.
2—2500 KW., G.E. Co., Turbo-Generator Condensing
2—2000 KW., G.E. Co., Turbo-Generator Condensing
1—2000 KW., W. E. & M. Co., Turbo-Generator Con.
3—1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 KW., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller. And Non-cond. Units.

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1000 KW. 250 v. steam engine generator set

500 KW. DC generator, 600 v. DC 900 speed, Allis Chalmers. Can assemble motor generator set

120 KW. 250/500 v. DC gasoline engine gen. set

312 KVA. West. synchronous frequency changer, 440 v. 30 cy. input, 440 v. 60 cy. output, 900 rpm.

145 KW. 125 v. Motor Generator Set, Westinghouse type SK 285 HP. syn. drive, 4150 v. or lower

70 KW. Motor Generator Set, 70 v. 1000 Amp. Burke, synchronous drive

150 KW. 250 v. West. SK, MG set, 2300 v. syn. drive.

667 KVA. transformers 23,000 volt primary 440 v. sec. 60 cy. single phase. Three units available.

1250 KVA. Ideal 2300/4000 volt, 60 cycle, 3 phase, 1200 rpm. synchronous generator

35 KW. 125 volt motor generator set. Any AC voltage drive.

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3—667 KVA. Westinghouse 23000 volt primary 575 volts secondary, single phase, 60 cycle.

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500 HP. 440 volt 3 phase 60 cycle 1200 rpm General Electric Squirrel cage motor.

500 HP. 550 volt 3 phase 60 cycle 450 rpm Westinghouse slip ring motor.

200 HP. 220 volt 3 phase 60 cycle 720 rpm General Electric synchronous motor.

MOTOR GENERATOR SET

100 KW. 125/250 volt 3-wire D.C. Westinghouse synchronous 25 cycle set.

D. C. GENERATORS

125 KW. 250/125 volt 3-wire D.C. General Electric DLC compound interpole, 650 rpm.

110 volt D.C. Generators from 10 to 100 KW. in stock.

ANDREN-MYERSON CORP.
411 Atlantic Ave., Boston, 10, Mass.

2—4000 KVA. 60 Cy. 3 Ph. TURBOS with Surface Condensers

HYDRO ELECTRIC UNITS
1625 KVA. 60 Cy., 250 RPM.
750 KW. 360 RPM. 60' Head.
700 KW. 257 RPM.
1500 HP. Impulse, 150 RPM.
1600 HP. 550' Head.
HEAT EXCHANGER 606 tubes 1¼"x9'8".

1500 CFM 2 STAGE AIR COMP.
275 HP. 60 Cy. 3 Ph. 2200 V. Syn. Motor Dr.

1100 Ton Hot Metal Mixer
24" Back Pressure Valve F&D.
3—20" VALVES—F&D, also Ells & Tees.
3—500 HP. STIRLING BOILERS 200#.

100 KW-550 V. TURBO
3600 Rev. 60 cy 3 ph—with dir. con. exciter
2—CENT. PUMPS 4166 GPM, 162' Head.
1—3600 GPM, 27' Head CENT. PUMPS.
TRAVELING CRANE, 75 ton Case, 64' Span,
750 KW. and 110 KW. AC HYDRO ELEC.
1—M-G SET. Motor 225 HP. 4100 V. 60 Cy. 3 Ph. driving 2-90 V. generators.
500 KW. NON-COND. 60 CY. TURBO.

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

SYNCHRONOUS MOTORS
160 HP. 720 RPM. 3/60/220-440 Volt Gen. Elec.
225 HP. 720 RPM. 3/60/220-440 Volt Gen. Elec.

SLIP RING MOTORS
50 HP. 600 RPM. 3/60/440 Volt Allis-Chalmers
150 HP. 514 RPM. 3/60/220 Volt Allis-Chalmers
300 HP. 514 RPM. 3/60/440 Volt Westinghouse

DC GENERATORS
55 KW. 125 Volt, 850 RPM. Westinghouse
75 KW. 250 Volt, 500 RPM. Northern

AC GENERATORS
50 KW. 1200 RPM. 3/60/2300 Volt Westinghouse
150 KW. 600 RPM. 3/60/220 Volt Gen. Elec.
200 KW. 720 RPM. 3/60/240 Volt Gen. Elec.

ENGINE GENERATORS
42KVA. 3/60/240 Volt General Elec.—Brownell
60 KW. 3/60/220 Volt Westinghouse—Ideal
75 KW. 3/60/480 Volt General Elect.—Skinner

Rockford Electric Equipment Co.
721 South Wyman St. Rockford, Ill.

VALVES
INDUSTRIAL & MARINE
METROPOLITAN PLUMBING SUPPLY CO., INC.
Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
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For Hourly Nation-wide Shipments
CALL MUrray Hill 3-3408
SKETCH PIPE & FITTINGS

NORDBERG UNIFLOW ENGINE
and
ALLIS-CHALMERS GENERATOR

Nordberg type 'S' poppet valve Uniflow Engine Duplex, cylinder sizes 22"x22'x36", 150 R.P.M., 200# steam pressure. Direct connected to Allis-Chalmers 850 K. W. Generator, 220 volt, 3 phase, 60 cycles. Exciter. Switchboards.

EXCELLENT CONDITION

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910 N. Marshfield Ave., Chicago, 22, Ill.

FOR SALE

470 KVA Westinghouse Turbo Generator Set.
Generator: 3 phase, 60 cycle, 480 volt, with direct connected exciter.
Turbine: Condensing Type, coupled direct to Generator.
Speed of unit — 3600 RPM.
Complete with Size No. 1 Westinghouse LeBlanc Condenser.

Write for our Electrical Machinery Stock List No. 441-E.

Morse Bros. Machinery Company
P.O. Box 1708 Denver 1, Colo.

THIS FOLDER GIVES ANSWERS TO PRODUCTION PROBLEMS

Get on our Mailing List to Receive this Folder and Regular Stock Lists

We have just finished printing an illustrated folder to show you why you can buy with confidence from The O'Brien Machinery Company. We've crammed it full of pictures that tell, better than words, that O'Brien is no "desk broker!" We show you our plant, our warehouse, our rebuilding shops, the assembly and testing departments. And there are many pictures of the types of machine tools and the power plant equipment that we rebuild, test and guarantee together with current lists of tools and equipment available.

A COPY OF THIS FOLDER WILL BE SENT YOU ON REQUEST.

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PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS
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OBRIEN PHILA

USED WATER TOWERS and TANKS

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20,000 to 250,000 gal. capacity; oil storage, pressure, all kinds of tanks; standpipes, gasoline and electric driven water pumps, fire pumps, and piping.

EVEREADY ELECTRIC & SUPPLY CO.
BRIDGEPORT 4, CONN.
E. J. McCallum, Jr., Pres.

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for IMMEDIATE SHIPMENT

LESLIE, Y-TYPE, SELF-CLEANING

Protection against scale and dirt for pumps, regulators, turbines, etc., in steam, air, gas or liquid service. Large free area, little flow resistance. Self-cleaning—no need to remove screen or shut down line, just blow down. May be used as condensate drain on steam lines. Supplied with brass screens in iron strainers, monel screens in steel strainers. Highest quality. Following metals and sizes on hand:

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CAST IRON

Screwed Ends ½ to 3" inclusive, 250 p.s.i. s.w.p.
Flanged Ends 125 p.s.i. s.w.p. 1½", 3½", 4", 5"
Flanged Ends 250 p.s.i. s.w.p. 1½", 2", 2½", 3", 3½", 4", 6"

BRONZE

Screwed Ends ½ to 2" inclusive, 300 p.s.i. s.w.p.
Flanged Ends 150 p.s.i. s.w.p. ¾", 1", 1¼", 2", 2½", 3", 4"
Flanged Ends 300 p.s.i. s.w.p. 1¼", 1½", 4"

CAST STEEL

Screwed Ends ½ to 2" inclusive, 500 p.s.i. s.w.p.
Flanged Ends 150 p.s.i. s.w.p. ½", ¾", 1¼" to 5" inclusive
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Flanged Ends 600 p.s.i. s.w.p. 1", 1½", 2½", 3", 4", 5", 6"

These are odd lots, so order today. ***First come, first served.***

LESLIE CO. **Lyndhurst, N. J.**

FOR SALE

1—400 KVA, 480 V. Gen. D/C 4-Val. Engine
1—65 HP. High Pressure Loco. Type Boiler
1—120 KVA, 240 V. Gen. D/C 4-Val. Engine
1—25 KW. 125 V. Non-condensing Turbo-Gen.
1—400 KW. 250 V. DC Gen. D/C Unaflow
1—4000 ft. Compressor; 130 HP HRT Boiler
1—750, 360, 150, 120, 60 HP Fuel Diesels
1—3 ft. Symons Cone Crusher—Rebuilt

H. & P. MACHINERY CO., 6719 Etzel, St. Louis.

1—2800 CFM modern plate valve Ingersoll-Rand ORC-3 compound 2 stage steam driven air compressor.
1—2000 CFM Norberg high efficiency plate valve Uniflow 2 stage air compressor.
Aftercoolers and air receivers available.
1—500 KVA Westinghouse geared turbo unit as new jet condenser 3 phase 60 cycle 2300/4000 volt.
1—1400 Hp. 4 to 1 Elliot speed reducer 3600/900 never used.
1—200,000# per hour Elliot closed feed water heater used very little.
2—414 Ft. head 250 GPM pumps.
2—525 Ft. head 240 GPM pumps.
100 other pumps.
60 other air compressors.
1000 motors.
62 motor generator sets.
17 large automatic motor starters above 100 Hp.

LEA ELECTRICAL EQUIPMENT CO.
359 West Chicago Ave. Chicago, Ill.
Superior 0747-48

FOR SALE

1—Bury Type CCS Steam Air Compressor. Air Compressor cylinder Sizes are: 12x12x20x12x14

Specifications:

2x12"—diameter high pressure steam cylinders x 20"—diameter low pressure air cylinder x 12"—diameter high pressure air cylinder x 14"—stroke. Displacement is 1180 C.F.M. at 230 R.P.M., 100# per sq. in. air pressure.

1—Griscom-Russell 2" extra-heavy 250# working pressure. Multi-screen terry cloths. Grease extractor with by-pass valves.

2—8"x5"x12" Dean Bros. Simplex outside center packed boiler feed pumps.

1—10"x12"x16" Union Steam Pump Co. Simplex Burnham vacuum pump.

2—4½"x3"x4" Gardner-Denver duplex oil pumps with oversize air chambers.

1—6" Oil Separator.

RUNDLE MANUFACTURING CO.
MILWAUKEE, WIS.

BOILERS

1—406 H.P. Titusville 3-drum 160 lb. pressure. New tubes and steel work.
2—300 H.P. Heine, 200 lbs. pressure.
1—250 H.P. Stirling Class A-18 with Foster Superheater, 150 lbs. pressure.

TURBO GENERATOR

1—Westinghouse 625 KVA condensing turbo generator set, 60 cycle, 3 phase, 2300 Volt. Injector condenser with switchboard.

JAMES T. CASTLE
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List equipment you want to sell with us. Our available equipment list includes a complete diesel plant consisting of three 160 HP—240 volt units and many other items.

Send us specifications of your needs.

HOWARD BLAINE JOHNSON & ASSOCIATES
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For Immediate Sale

Boilers and Stokers

Iron Fireman Stoker #4112 Capacity 15,000 sq. ft. radiation.

Iron Fireman Stoker #4A Capacity 75,000 sq. ft.—Rebuilt

1 Kewanee HRT boiler #316 Capacity 70 h.p. Operates at 15 lbs. pressure

1 Kewanee HRT boiler #1783 Capacity 90 h.p., 100 lb. pressure. Operates at 100 lbs. pressure

2 Iron Fireman Stokers for above boilers

Harris-Seybold-Potter Co.
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SELL YOUR SURPLUS EQUIPMENT

IT IS NEEDED TO SPEED THE WAR'S END

DSD INC. ORGANIZATIONS

We have a demand for your surplus and idle equipment—a single item or a complete plant. Send us your list of such equipment—and put it to work where it is needed most.

WE PURCHASE ON A CASH BASIS

DULIEN STEEL PRODUCTS, INC.

of Washington	*of California*	*of New York*
200 NATIONAL BLDG.	11611 SO. ALAMEDA	2280 WOOLWORTH BLDG.
SEATTLE 4, WASH.	LOS ANGELES 2, CALIF.	NEW YORK 7, N. Y.

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BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

1100 HP DIESEL GENERATING

POWER PLANT

Diesel Engine Units: 1100 HP
1—500 HP Busch Sulzer, 350 Kw, 3/60/2300
1—300 HP Fairbanks Morse, 200 Kw, 3/60/2300
1—200 HP Fairbanks Morse, 136 Kw, 3/60/230
1—100 HP Fairbanks Morse, 72 Kw, 3/60/2300
Complete with steel frame building and other aux. equip.....$50,000
1—150 HP Fairbanks Morse six cyl., direct reversible marine diesel engine complete with auxiliary equipment...$3500

DIESEL ENGINES OF ALL SIZES AVAILABLE

Eveready Electric & Supply Co.
Established 1929
Shop and Office
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Phone 4-1762 and 4-1787 E. J. McCallum, Jr. Prop.

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Allis Chalmers

100 KVA, 220 V., 3 phase, 125 HP Sterling Marine Motor, converted for Butane with 100 Gal. Butane Tank, 4 cylinder Dodge motor DC to Farnsworth Exciter, complete with panel board.

D. B. Lewis Co.,
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2000 to 3000 KW 6 phase, 60 cycle—600 volt direct current rotary converter equipped with 26,400 volt transformers, alternating and direct current control panels and instruments. Must be in first-class usable condition. Furnish nameplate data with price.

W-717, Power
520 North Michigan Ave., Chicago 11, Ill.

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2500 H.P. G.E. MOTORS

Sacrifice Prices—Spot Delivery

8—2500 H.P. GENERAL ELECTRIC INDUCTION MOTORS. Type MT-28-2500-257, Form AE, 60-cycle, 3-phase, 6600 Volts, 202 - amp., secondary volts 706, secondary amps. 1530, speed full load 253 R.P.M., continuous rise 40 degrees centigrade. With starting equipment.

Motor Numbers:—5283038, 5283041, 5283042, 5283044, 5283046, 5283048, 5283049, 5283050.

SAMUEL HUBERMAN
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Telephone Evergreen 7-3277 — 7-7344

VACUUM PUMPS

2—Simplex Steam 10"x14"x12"

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

Diesel Engines: *225 HP* Chic. pneum. 720 RPM. 6 cyl. Pulley etc. *120 HP* Atlas 650 RPM. 6 cyl. Clutch etc. *D-8800* Caterpillar with Generator 3/60/2300 v.

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Good USED Equipment

is frequently the difference between having needed equipment or doing without it.

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HASTINGS-ON-HUDSON, NEW YORK

Tuesday, August 15, 1944, starting at 11:00 a. m. E.W.T.

Consisting of: Asphalt Stills, Grinders, Mixers, Presses, Elevators, Conveyors, Pumps, Compressors, COMPLETELY EQUIPPED MACHINE SHOP, and especially:

2—SKINNER HORIZONTAL UNI-FLOW ENGINES:

1—550 HP, size 23 x 23, 180 RPM
1—250 HP, size 19 x 20, 200 RPM

Both complete with Valves and Fittings and connected to Wheeler Condenser.

Send for Detailed, Illustrated Circular!

INDUSTRIAL PLANTS CORP.

90 West Broadway, New York City

Telephone: Barclay 7-4185

COMPLETE TURBO GENERATOR PLANT

Practically New. In Operation 18 Months Only.

1—Murray Standard Turbine 300 H.P., 150 lb. steam pressure, 2 lb. back pressure, 4 stage, 3600 RPM—includes separator and trap, 4-inch tracifier and 2-inch steam trap.

1—Allis Chalmers A.C. Generator, 200 KW, 240 volt, 603 amps., 60 cycle, 3-phase 3600 RPM.
Excitation, 125 volts, 42 amps., continuous full load.

Exciter, direct connected to generator. 125 volt full load 52 amp., 3600 RPM.

1—Switchboard Complete with voltmeter and ammeter for exciter and generator, oil switch, rheostat, exciter switch, electric meter, steam-flow meter, and latest Allis-Chalmers rocking contact voltage regulator.

PIONEER LAUNDRY AND DRY CLEANING CO.

1291 Sixty-Third Street Oakland 8, Calif.

FOR SALE

400 H.P. INGERSOLL-RAND FULL DIESEL ENGINE 6 Cyl., 4 Cycle, 360 RPM, Including spare parts.
30 K.W. Ideal Elec. Mfg., D.C. Generator 115 V. 800 RPM, Compound Interpole Single Bearing.

ALJON ELECTRIC DIESEL CO.
151-55 Washington St. Brooklyn 1, N. Y.
Main 4-3804

COMPRESSORS

Over 150 in stock

New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 3500 CFM

AMERICAN AIR COMPRESSOR CORP.

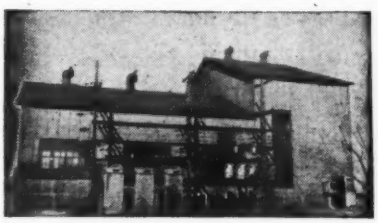
Dell Ave. & 48th St., North Bergen, N. J.

For Additional Used Equipment advertisements see

Pages 326 and 348

FOR SALE

DIESEL PLANT



Now Operating—Immediate Release

Busch-Sulzer 500 HP—350 KW
Fairbanks-Morse 300 HP—200 KW
Fairbanks-Morse 200 HP—136 KW
Fairbanks-Morse 100 HP—72 KW
Generation 2300 Volts 3 Phase 60 Cycle
Transmission 1300 Volts 3 Phase Wye

Descriptive bulletin on request.

NEW MEXICO ELECTRIC SERVICE CO.

Box 239 Dallas, Texas

POWER PLANT OPERATORS ATTENTION!

CAST IRON FITTINGS

(For 125-150 Pound Pressure)

FLANGED ELBOWS—90°

85—2"	I.P.S.	300— 6"	I.P.S.
105—2½"	I.P.S.	210— 8"	I.P.S.
70—3"	I.P.S.	50—10"	I.P.S.
100—4"	I.P.S.	35—12"	I.P.S.
65—5"	I.P.S.	60—20"	I.P.S.

FLANGED ELBOWS—45°

105—2"	I.P.S.	215— 6"	I.P.S.
125—2½"	I.P.S.	105— 8"	I.P.S.
160—3"	I.P.S.	60—10"	I.P.S.
80—4"	I.P.S.	35—12"	I.P.S.
40—5"	I.P.S.	20—20"	I.P.S.

FLANGED TEES—STRAIGHT

130—2"	I.P.S.	140— 6"	I.P.S.
60—2½"	I.P.S.	85— 8"	I.P.S.
85—3"	I.P.S.	60—10"	I.P.S.
110—4"	I.P.S.	50—12"	I.P.S.
65—5"	I.P.S.	15—20"	I.P.S.

FLANGED TEES—REDUCING
A large assortment in stock.

FLANGED CROSSES
From 2" I.P.S. to 24" I.P.S.

ASSORTED MISC. FITTINGS, FLANGED
Including Reducers, Reducing Elbows, Steam Headers, Etc.

BRASS VALVES—SCR'D

(Reconditioned & Guaranteed)

GATES, GLOBES, SWING CHECKS
In all sizes from ¼" to 3". Huge stock from which to choose.

BRONZE & I. B. B. M. VALVES

(Reconditioned & Guaranteed)

FLANGED GATES & GLOBES
From 4" to 24"—Thousands in stock for immediate delivery.

20" C.I. PIPELINE

275 feet long, in perfect condition.

PUMPS—IRON & BRONZE

Steam & Motor Driven—Various Sizes.

Also available from stock

PEABODY OIL BURNER
Never used. Suitable for 150 H.P. Boiler.

ACE AUTOMATIC COMBUSTION OIL BURNER
Type DRF-Model 14-Complete with 2½ H.P. 3500 RPM 60 cycle 110 V Howell Red Band Motor.

STEEL BOILER STACK
13'0" Dia. Base—8.8"Dia. Top—135'0" Hight. Complete with breeching.

CONDENSERS
From 100 to 2500 Sq. Ft.

A large stock of process plant equipment — write for list

Sell us your surplus equipment

ORELAND EQUIPMENT CO.

P. O. BOX "E", ORELAND, PENNA.

(Additional Searchlight Advertising Continued on page 348)

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Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEERS
Design Operations
Steam - Hydraulic - Gas
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Established 1909
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Steam and Electric Power Distribution Systems
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Engineers and Constructors
for the
FINANCING—REORGANIZATION—
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of
INDUSTRIAL and PUBLIC UTILITIES
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Power Plant Design and Construction
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Steam — Diesel — Hydro
Reports—Examinations—Laboratory
Industrials and Utilities
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SARGENT & LUNDY
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140 South Dearborn St.
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THE J. G. WHITE ENGINEERING CORPORATION
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BOILER WATER CONDITIONING
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Power Plants *Engineers* Consultation
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ZUCE KOGAN CONSULTING SERVICE
NEW OR REHABILITATION OF
Steam Generating Plants
Power Steam & Diesel Plants
Combustion & Furnace Design
2967 S. LaSalle St., Chicago 16

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

READERS MAY CONTACT THE CONSULTANTS
whose cards appear on this page
with the confidence justified by the offering of these special services nationally.

SEARCHLIGHT SECTION

(Continued from page 347)

1 ELLIOTT COMPANY—USED

RIDGWAY STEAM ENGINE

of the following specifications:
138 H. P.; 225 RPM; 16" Bore; 16" Stroke; Size V; 100# Max. Steam Pressure; 15# Back Pressure.

Engine in first class condition and can be inspected and seen in operation at refinery.

For further details, contact

THE NATIONAL REFINING CO.
5th floor Hanna Bldg.
E. J. Bolt Cleveland, 15, Ohio

FOR SALE

Electric Revolvator Stacker

1500# Capacity—Overall height 10'—Steel platform size 36" x 38". Platform speed in both directions 20 FPM, equipped with high torque reversing type motor—2 HP, 220V—Single Phase. Also Beaumont Skip Hoist.—Drum carries 21 strands ⅝" wire rope—200' of rope available. Motor to operate hoist direct connected DC—110 V —7½ HP—700 RPM.

EMPIRE BOX CORPORATION
GARFIELD, NEW JERSEY

IN STOCK

100—½ HP Brown & Brockmeyer 110/220 V. 1700 RPM 1 phase motors

100—¾ HP Westinghouse Capacitor Type 110/220 V. 1700 RPM, 1 phase motors

100—1 HP Brown & Brockmeyer 110/220 V. 1700 RPM, 1 phase motors

2—31½ KVA 3 phase 60 cycle 208/120 V. Gasoline Engine Sets

5—35 KVA 3 phase 60 cycle 120 V. Gasoline Engine Sets

1—35 KVA 3 phase 60 cycle 208/120 V. Hercules Diesel Engine Set

1—16 KW DC 110 Volt Hercules Diesel Portable Engine Set

We have many other items too numerous to mention such as DC & AC motors, generator, motor-generators, transformers, air compressors, etc.

WIRE — WRITE — PHONE

BENJAMIN'S FOR MOTORS

12 Ave. & 37 St. Brooklyn 18, N. Y.

LET THE PLIBRICO HAMMER BREAK YOUR "BOTTLE-NECK"

Plibrico is highest-grade refractory material in moist, plastic form. It is installed with a steel hammer, trimmed to a smooth surface, then baked out by the fire. Every blow of the Plibrico hammer is a blow at trouble and expense.

IS refractory construction the bottle-neck which is restricting your production? Are you hampered and inconvenienced by furnace troubles? Then Plibrico Jointless Firebrick is the answer to your problem.

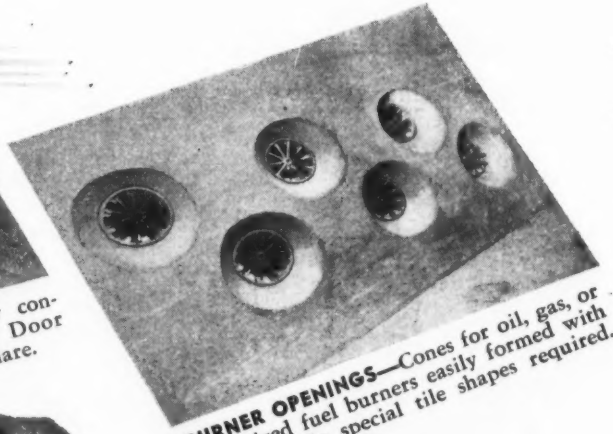
Plibrico saves time, money, and trouble since it is readily adaptable to all types of furnace construction. You can meet any emergency with Plibrico—can get your boilers back into service faster, and often at less expense.

Plibrico not only gets your boilers back into operation faster but it keeps 'em in service longer without interruptions. Monolithic Plibrico linings last longer because they eliminate the weaknesses of other types of refractory construction.

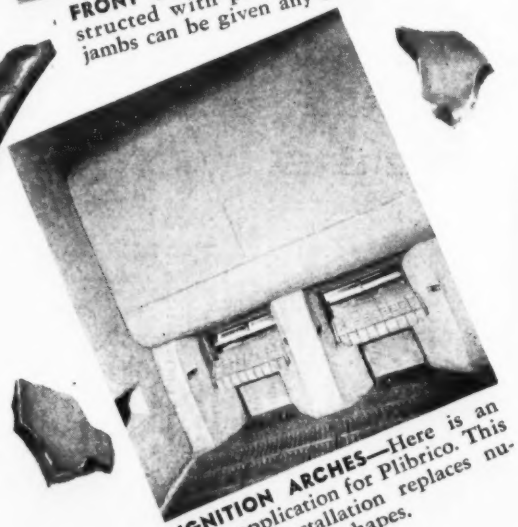
Plibrico is ideal for all types of boilers—water tube, H.R.T., Scotch marine, etc. Distributors in 100 cities in the U. S. and Canada furnish installation and boiler setting service, or your own maintenance men can install Plibrico. Write for catalog; specify type of boiler.

PLIBRICO JOINTLESS FIREBRICK CO.
1818 Kingsbury St., (Dept. H), Chicago 14, Ill.
Factories: Chicago, Ill.; Trenton, N. J.; Firebrick, Ohio

FRONT DOOR ARCHES—Readily constructed with plastic Plibrico. Door jambs can be given any desired flare.

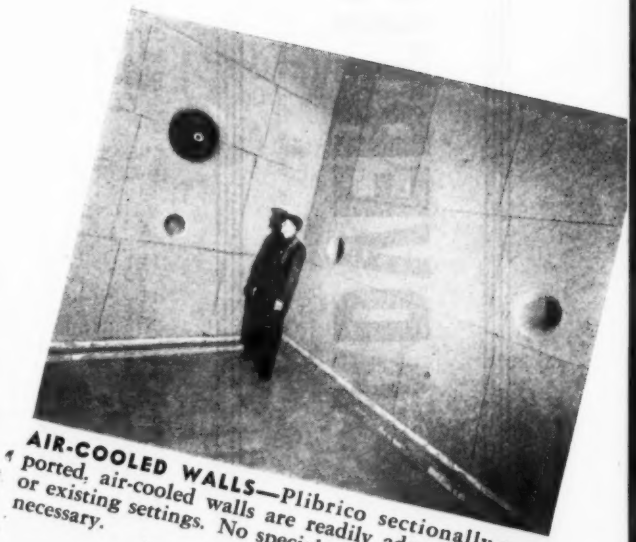


BURNER OPENINGS—Cones for oil, gas, or pulverized fuel burners easily formed with Plibrico. No special tile shapes required.



IGNITION ARCHES—Here is an ideal application for Plibrico. This Plibrico installation replaces numerous special shapes.

SUSPENDED ARCHES—Plibrico suspended arches can be built in any shape or contour. Supported by simple steelwork or existing hangers.



AIR-COOLED WALLS—Plibrico sectionally-supported, air-cooled walls are readily adapted to new or existing settings. No special tile or heavy castin- necessary.

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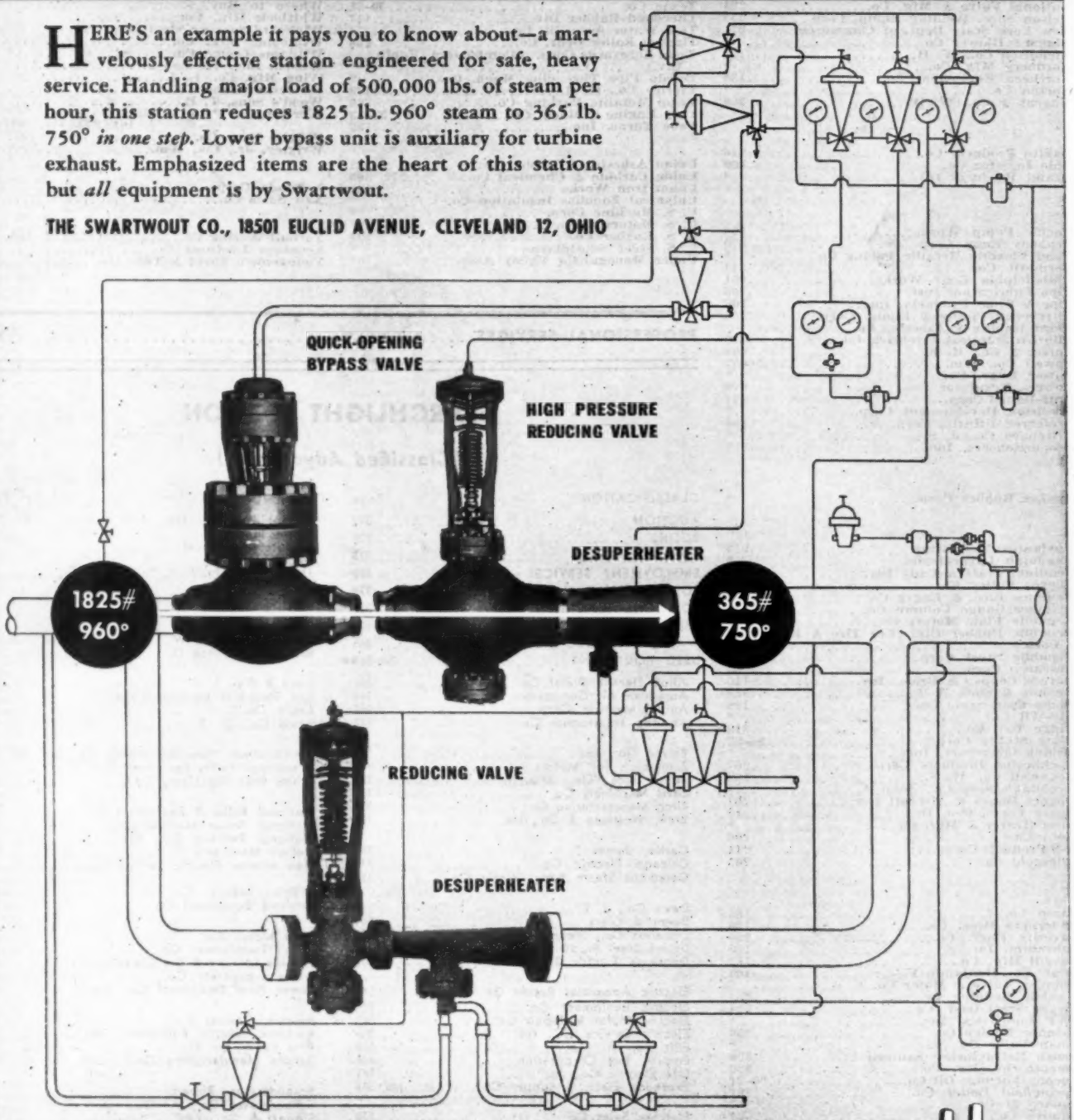

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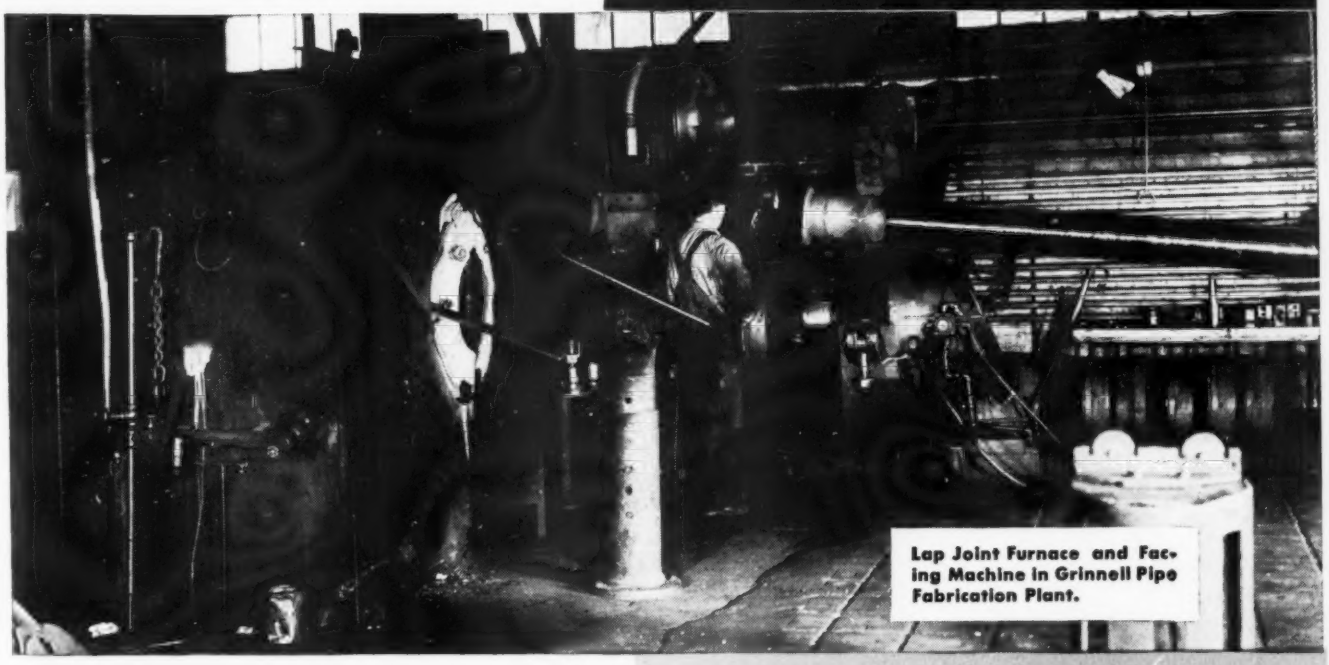

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